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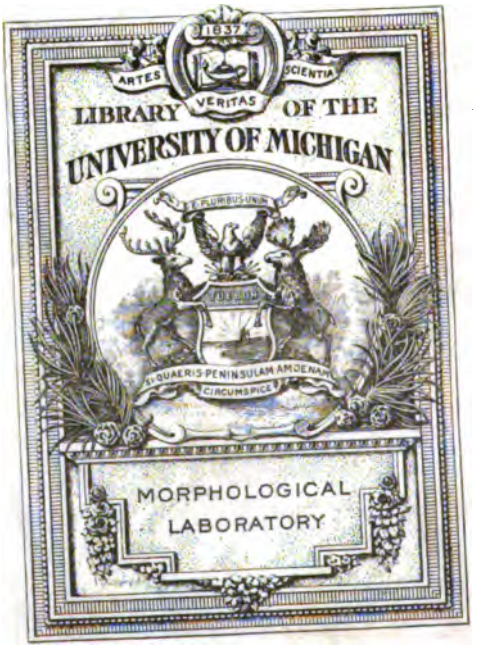
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CATALOGUE

OF THE

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IN THE

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BY

ALBERT GÜNTHER,
M.A., M.D., PH.D., F.R.S., ETC., ETC.

VOLUME SIXTH.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES.
1866.

CATALOGUE

OF THE

PHYSOSTOMI,

CONTAINING THE FAMILIES

SALMONIDÆ, PERCOPSIDÆ, GALAXIDÆ, MORMYRIDÆ,
GYMNARCHIDÆ, ESOCIDÆ, UMBRIDÆ, SCOMBRESOCIDÆ,
CYPRINODONTIDÆ,

IN THE

COLLECTION

OF THE

BRITISH MUSEUM.

BY

DR. ALBERT GÜNTHER.

LONDON:
PRINTED BY ORDER OF THE TRUSTEES.
1866.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.

PREFACE.

Dr. Günther observes,—"This volume contains the continuation of the families of *Physostomi*. At the commencement of my account of this order it was my intention to adopt it with the limits assigned to it by Müller, and to distinguish the *Scombresoces* as a distinct order, viz. *Malacopterygii pharyngognathi*; however, during the progress of a detailed examination of these fishes so many points of affinity with the Cyprinodontes became apparent, that I was reluctantly obliged to deviate still more from Müller's ordinal division.

"The Salmonidæ and the vast literature on this family offer so many and so great difficulties to the Ichthyologist, that as much patience and time are required for the investigation of a single species as in other fishes for that of a whole family. The ordinary method followed by naturalists in distinguishing and determining species, is here utterly inadequate; and I do not hesitate to assert that no one, however experienced in the study of other families of fishes, will be able to find his way through this labyrinth of variations without long preliminary study, and without a good collection for constant comparison. Sometimes forms are met with so peculiarly and so constantly characterized, that no ichthyologist who has seen them will deny them specific rank; but in numerous other cases one is much tempted to ask whether we have not to deal with a family which, being one of the most recent creation*, is composed of forms not yet specifically differentiated.

"The small family *Umbridæ* proves to be one of great interest. Represented by two species, one in Central Europe, and the other in North America, the close affinity of which is here recognized for the first time, it forms one of the most striking instances against the theory of the geographical continuity of identical forms.

* No fossil true Salmo is known at present; the nearest fossil approaching to it is a *Mallotus*.

"The *Cyprinodontidæ* required a through reexamination and rearrangement. Their division into carnivorous and limnophagous species will be found to be very natural.

"The number of species treated of in this volume amounts to 548, a few of which are mentioned by name only. Cuvier & Valenciennes described 270 species in the corresponding parts of the 'Histoire Naturelle des Poissons.'

"Numerous and valuable additions to the National Collection have been received since the publication of the last volume; and I feel the more pleasure in referring to them, as a great part have been given to assist in the completion of the present volume:—

"1. Fine examples of British Salmonidæ have been presented by His Grace the Duke of Roxburgh, His Grace the Duke of Argyle, the Earl of Enniskillen, the Rev. Chancellor Augustus Morgan, Lord Lovat, Capt. J. B. Dunbar, the Right Hon. Earl Cowper, Lord Portsmouth, W. Peel, Esq., of Taliaris, S. P. W. Ellis, Esq., F. Godman, Esq., F.Z.S., G. Smith, Esq., J. Gould, Esq., F.R.S., J. H. Gurney, Esq., T. Chamberlayne, Esq., R. Franklin, Esq., the late Sir J. Richardson, A. Smee, Esq., F.R.S., Major Scott, of Knaith Hall, J. H. Phillips, Esq., W. B. Tegetmeier, Esq., W. F. Ffennell, Esq., F. Allies, Esq. The kind assistance of these gentlemen and of Sir Philip de M. G. Egerton, Bart., M.P., has enabled me to bring together a very fine series of British Salmonoids, perhaps the most complete collection ever made available for zoological purposes.

"2. A Collection of Danish Salmonoids, presented by the Royal Museum of Copenhagen.

"3. A Collection of the Salmonoids of the Lake of Constance, presented by Prof. W. von Rapp, of Tübingen.

"4. A Collection of Norwegian Salmones, presented by Prof. N. St. Maskelyne.

"5. Specimens of Iceland Char, presented by G. G. Fowler, Esq., of Gunton Hall.

"6. Specimens of Trout from the Atlas, presented by Dr. Schimper, of Strasburg.

"7. Specimens of Dalmatian Trout, presented by G. Lenox Conyngham, Esq.

"8. Specimens of the Great Lake-Trout of Geneva, presented by M. G. Lunel, of the Geneva Museum.

"9. A large Collection of the Freshwater Fishes of Sweden and Lapland, made by the late Mr. Wheelwright.

"10. Several large Collections of the Fishes of Zanzibar, made and presented by Lieut.-Col. Playfair, H.M. Consul at Zanzibar.

"11. The typical specimens of Scombresoces described by Dr. P. Bleeker.

"12. Further Collections of Marine and Freshwater Fishes from Australia, sent by G. Krefft, Esq.

"13. A large Collection of Marine and Freshwater Fishes from Trinidad, purchased of Mr. Cutter.

"14. Numerous examples of Cyprinodonts from Trinidad, presented by R. J. L. Guppy, Esq.

"15. A further Collection of Marine and Freshwater Fishes from the Pacific coast of Panama, presented by Capt. Dow, Corr. M. Zool. Soc.

"16. A Collection of the Fishes of the Island of Formosa, made by R. Swinhoe, Esq., F.Z.S.

"17. A further Collection of West African Freshwater Fishes, purchased of Mr. Dalton.

"18. A Collection of Marine Fishes from the Cape de Verde Islands, made and presented by the Rev. R. T. Lowe.

"19. A Collection of Marine and Freshwater Fishes made at Nice by Dr. Deakin."

JOHN EDWARD GRAY.

British Museum,
Dec. 1, 1865.

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CATALOGUE

OF

FISHES.

Subclass I. TELEOSTEI.

(CONTINUED.)

Order IV. PHYSOSTOMI.

(CONTINUED.)

Fam. 7. SALMONIDÆ.

Salmonidæ, *Müll. Abhandl. Acad. Wiss. Berl.* 1844, p. 186.

Body covered with scales*, head naked; barbels none. Margin of the upper jaw formed by the intermaxillaries mesially, and by the maxillaries laterally. Belly rounded. A small adipose fin behind the dorsal. Pyloric appendages generally numerous, rarely absent. Air-bladder large, simple; pseudobranchiæ present. The ova fall into the cavity of the abdomen before exclusion.

Fresh waters of the temperate and arctic regions of the northern hemisphere, many species periodically descending to the sea. One genus from New Zealand; two genera pelagic.

* See *Salanx*, p. 205.

7

Synopsis of the Genera.

A. *Dorsal fin opposite or nearly opposite to ventrals*: SALMONINA.

Scales small; dentition strong and complete; maxillary long*; cæc. pyl. numerous; anal rays 14 or less ..... 1. SALMO, p. 2.

Scales small; dentition strong and complete; maxillary long; cæc. pyl. numerous; anal rays more than 14..... 2. ONCORHYNCHUS, p. 155.

Scales small; teeth rather feeble; maxillary short and broad; anal short. 3. BRACHYMYSTAX, p. 162.

Scales of moderate size; dentition very feeble, incomplete; maxillary long; cæc. pyl. numerous ..... 4. LUCIOTRUTTA, p. 164.

Teeth feeble, a part compressed, laminated ..... 5. PLECOGLOSSUS, p. 165.

Scales of moderate size; dentition complete, fang-like teeth on the vomer and tongue; maxillary long; cæc. pyl. in small number. 6. OSMERUS, p. 166.

Scales small; dentition incomplete, very feeble; maxillary long; cæc. pyl. in moderate number ..... 7. THALEICHTHYS, p. 168.

Scales small; dentition incomplete, very feeble; maxillary thin and short. 8. HYPOMESUS, p. 169.

Scales very small; dentition complete, feeble; maxillary extending to below the middle of the orbit; cæc. pyl. in small number. 9. MALLOTUS, p. 170.

Scales of moderate size; dentition complete, feeble; cleft of the mouth of moderate width; dorsal behind ventrals; cæc. pyl. none. 10. RETROPINNA, p. 171.

Scales of moderate size; teeth minute, if present; maxillary short and broad; dorsal short; cæc. pyl. numerous ..... 11. COREGONUS, p. 172.

Dorsal fin long, many-rayed ..... 12. THYMALLUS, p. 200.

Scales rather large; jaws toothless, palate with small teeth; maxillary very short, not extending to orbit; dorsal short; cæc. pyl. in moderate number. 13. ARGENTINA, p. 202.

Scales large, very thin; very small teeth in lower jaw and on vomer, no other teeth. Cleft of mouth very small. Adipose fin rudimental. Cæc. pyl. none. 14. MICROSTOMA, p. 204.

B. *Dorsal fin placed far behind the ventrals*: SALANGINA.

Body naked (?)..... 15. SALANX, p. 205.

First Group. SALMONINA.

1. SALMO.

Salmo, *Artedi, Genera*, p. 11.
Salmo, Fario *et* Salar, *Cuv. & Val.*

Body covered with small scales. Cleft of the mouth wide, the maxillary extending to below or beyond the eye. Dentition well developed; conical teeth in the jaw-bones, on the vomer and palatines, and on the tongue, none on the pterygoid bones. Anal short, with less than fourteen rays. Pyloric appendages numerous; ova large.

* In the adult fish.

Young specimens with dark cross bands; the form of the caudal fin changes with the age and sexual development of the fish, immature individuals having it more deeply emarginate. In males the lower jaw is more developed than in females, and sometimes curved upwards into a hook.

Inhabitants of the fresh waters of the arctic and temperate parts of the northern hemisphere, many species descending to the sea after having deposited their spawn.

THERE is no other group of fishes which offers so many difficulties to the Ichthyologist, with regard to the distinction of the species as well as to certain points in their life-history, as this genus. Moreover by far the greater portion of the voluminous literature on these fishes consists of descriptions giving trivial or general characters only, frequently confounding two or three species, or representing as species what are, in fact, merely variations of sex, age, &c.; so that the task of giving an account of all the species noticed by authors has not been an easy one, and their history (in its present form) must form one of the most unsatisfactory portions of Ichthyology.

The almost infinite variations of these fishes are dependent on age, sex and sexual development, food, and the properties of the water. We shall subsequently see that at least some of the species interbreed, and it is probable, although at present not confirmed by direct observation, that such hybrids mix again with one of the parent species, thereby producing an offspring more or less similar to the pure breed. The *coloration* is, first of all, subject to variation; and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages of development the same kind of coloration. The young of all the species of this genus are barred; and this is so constantly the case that it may be used as a generic or even as a family character, not being peculiar to *Salmo* alone, but also to *Thymallus* and probably to *Coregonus*. The number of bars is not quite constant, but the migratory Trout have two (and even three) more than the River-Trout. When the Salmones have passed this "Parr"-state, the coloration becomes much diversified. The males, especially during and immediately after the spawning-time, are more intensely coloured and variegated than the females, specimens which have not attained to maturity retaining a brighter silvery colour, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh: thus, the more variegated specimens are frequently out of condition, whilst well-fed individuals with pinkish flesh are of a more uniform though bright coloration. Chemistry has not supplied us yet with an analysis of the substance which gives the pink colour to the flesh of many Salmonoids; but there is little doubt that it is identical with, and produced by, the red pigments of many Salt- and Fresh-water Crustaceans which form a favourite food for these fishes. The water has a marked influence on the colours: Trout with intense ocellated

spots are generally found in clear, rapid rivers and in small, open, alpine pools; in the large lakes with pebbly bottom the fish are bright-silvery, and the ocellated spots are mixed with, or replaced by, X-shaped black spots; in pools or parts of lakes with muddy or peaty bottom the Trout are of a darker colour generally, and when enclosed in caves or holes they may assume an almost uniform blackish coloration. The brackish or salt water has the effect of giving them a bright-silvery coat, without or with comparatively few spots, none of which are ocellated. Now some of the species like *S. fario* inhabit all the different waters indicated, even brackish water, and therefore we find an immense variation of colour in one and the same species; others are more restricted in their habitat, like *S. salar*, *S. ferox*, &c., and therefore their coloration may be more precisely defined.

With regard to *size* the various species do not present an equal amount of variation. Size appears to depend on the abundance of food and the extent of the water. Thus, the Salmon and the different kinds of Great Lake-trout do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. A widely spread species, however, like *S. fario*, when it inhabits a small mountain-pool with scanty food, never exceeds a weight of eight ounces, while in a large lake or river where it finds an abundance and variety of food it attains to a weight of fourteen or sixteen pounds. Such large River-trout are frequently named and described as Salmon-trout, Bull-trout, &c.

The *proportions of the various parts of the body to one another* vary exceedingly in one and the same species. First of all, we find in young Salmonoids the same peculiarities which characterize a young fish generally (short snout, large eyes, cylindrical body, &c.), or in mature ones those indicating the development of the sexual organs (prominent abdomen, great depth of the body). But in scarcely any other group of fishes do we observe a similar change in the form of the snout. In the mature male the intermaxillaries and the mandible are produced in various degrees, and the latter is frequently more or less bent upwards. Hence the males have the snout much more pointed and produced, and the entire head longer, than the females; with the intermaxillary bone the teeth with which it is armed are also enlarged, sometimes to four times the size of those of the females. And if this development of the front part of the head happens to be going on while the individual is able to obtain only a scanty supply of food, the usual proportions of the head and trunk are so altered that the species is very difficult to recognize. Barren male fish approach the females in the proportions of the head and body, but hybrid fishes do not differ in this respect from their parents. The abundance or scarcity of food, and the disposition or indisposition of the Salmonoids to feed, are other causes affecting the growth or fulness of the various parts of the body. In well-fed fishes the head is proportionally not only smaller, but also shorter, and *vice versâ*.

The *fins* vary to a certain degree. The variation in the number of the rays is inconsiderable and of no value for specific distinction; we

know of one example only (of *S. cambricus*) where the usual number of the rays of the anal fin is increased by two, and we are still uncertain in what light this variation ought to be considered. Although some species appear to be distinguished by a conspicuously low dorsal and anal fin, yet the proportion of the height of these fins to their length is a rather uncertain character. In most of the species the fin-rays are longer during the earlier stages of growth or development, but in a few we have observed that mature individuals have had the fins comparatively longer than immature ones. The caudal fin especially undergoes considerable changes with age, and dependently upon the sexual development. Young specimens of all species have this fin more or less deeply excised, so that the young of a species which has the caudal emarginate throughout life is distinguished by a deeper incision of the fin from the young of a species which has it truncate in the adult state. We shall subsequently see that the individuals of a species do not all attain to maturity at the same age and at the same size. Hr. Widegren first pointed out that mature individuals generally have the caudal less deeply excised than immature ones of the same age and size. It is therefore evident that the variations in the form of the caudal are considerable and numerous, and that it is a very fallacious character if due regard be not paid to the age and sexual development of the fish. Further, species inhabiting rapid streams as well as still waters show considerable variations in the form and length of all the fins; those individuals which live in rapid streams, being in almost constant motion and wearing off the delicate extremities of the fins, have the fin-rays comparatively shorter and stouter, and the fins of a more rounded form, particularly at the corners, than individuals inhabiting ponds or lakes (see p. 149); moreover one and the same individual may pass a part of its life in a lake, and enter a river at certain periods, thus changing the form of its fins almost periodically.

Finally, to complete our enumeration of these variable characters, we must mention that in old males, during and after the spawning-season, the *skin* on the back becomes thickened and spongy, so that the scales are quite invisible, being imbedded in the skin.

After this cursory review of *variable characters*, we pass on to those which we have found to be *constant* in numbers of individuals, and in which it is difficult to perceive signs of modification due to external circumstances. Such characters, according to the views of the zoologists of the present age, are sufficient for the definition of species: at all events, in every description, they ought to be noticed, and the confused and unsatisfactory state of our knowledge of Salmonoids is chiefly caused by authors having paid attention to the more conspicuous, but unreliable characters, and but rarely noted one of those which are enumerated here:—

1. *The form of the præoperculum of the adult fish.* The præoperculum is composed of a vertical (posterior) and horizontal (lower) part (limb), both meeting at a more or less rounded angle. The development of the lower limb is a very constant character: in some species (as in the Salmon) it is long, in others (*S. ferox*, *S. brachy-*

poma) exceedingly short. The adjoined woodcuts will readily show the difference:—

Præoperculum.

S. salar.

Præoperculum.

S. brachypoma.

In young specimens of all Salmonoids the præoperculum has a very short lower limb; but whilst in some species it lengthens with age, its development in a horizontal direction is arrested in others.

2. *The width and strength of the maxillary of the adult fish.* To show this character in two distinct species, we have given woodcuts of the maxillaries of females (12 inches long) of *S. fario* and *S. levenensis* of the same size.

S. fario.

S. levenensis.

In young specimens of all Salmonoids the maxillary is comparatively shorter and broader, somewhat resembling that of a *Coregonus*; yet this bone offers a valuable character for the determination of the young of some species; for instance, in a young *S. cambricus* it extends scarcely to below the centre of the eye, whilst in a *S. fario* of the same size it reaches to, or even beyond this point.

3. *The size of the teeth, those of the intermaxillaries excepted.*

4. *The arrangement and the permanence or deciduousness of the vomerine teeth.* In some species the vomer is normally armed with a double or single series throughout life, although of course some of the teeth are frequently accidentally lost; in others these teeth disappear gradually with age, the hinder ones first, so that finally the anterior only remain. In order to ascertain the arrangement of the teeth, it is necessary to remove the gingiva. Frequently the teeth stand in a distinctly double or single series, or they are placed alternately; but frequent irregularities occur which render this character vague, or even unsafe, so that some zoologists have rejected it entirely as unreliable. However, when a greater number of individuals, really belonging to the same species, are examined, a pretty safe conclusion may be arrived at as regards the arrangement of these teeth.

5. *The form of the caudal fin in specimens of a given size, age, and sexual development.*

6. *A great development of the pectoral fins when constant in individuals from the same locality.*

7. *The size of the scales*, as indicated by the number of transverse rows above the lateral line,—one of the most constant characters.

8. *The number of vertebræ.* Considering the great number of vertebræ in Salmonoids, the constancy of this character is truly surprising. An excess or a diminution of the normal number by two, is of rare occurrence, and generally to be explained by the fact that one vertebra has been abnormally divided into two, two such vertebræ being considerably smaller than the others—or on the other hand that two have merged into one, which is then unusually large, and provided with two neural spines. We have seen one case only where three vertebræ were united. The number of vertebræ can be easily ascertained in specimens destined for preservation in spirits, by an incision made along one side of the fish, a little above the lateral line.

9. *The number of pyloric appendages.* There can be no doubt that this character may materially assist in fixing a species. We shall see that in some species it varies from 30 to 50; but in others, as in the Salmon and Charr, it has been found very constant. If unexpected variations occur, their cause may be found in a partial confluence of the cæca, as we have observed that specimens of *S. levenensis* (a species normally with from 70 to 90 cæca) had those appendages of unusual width when the normal number was diminished.

We have not thought it superfluous to enter into these details (which will be illustrated by instances in the following pages), in order to show that it is only by a close, long-continued study, and constant comparison of specimens of various ages and from various localities, that one is enabled to find a guide through this labyrinth of confusing variations. But when we find that the very same characters by which we are enabled to distinguish European species occur again, though in an exaggerated form, in American Salmonoids (which everybody will admit to be of distinct species), our faith in them necessarily becomes strengthened; and we no longer hesitate, in accordance with acknowledged principles in zoology, to represent as separate species those which are distinguished from their congeners by a combination of two or more of those constant characters. It has been asked us whether we believed that the forms recorded here as species were derived from separate or common parents. It is not the task of descriptive zoology to determine this question; for the present, the facts which should prove a gradual creation of the species, and demonstrate the forefather of a recent form, are so obscure that any view on the subject must still be a matter of opinion. The question whether the Trout enumerated below should be regarded as distinct species or not, is perfectly independent of such considerations and no more to be affected by them than the question whether *Salmo* and *Coregonus* are distinct genera. Whenever the zoologist observes

two forms distinguished by peculiarities of organization such as cannot be conceived to be the effects of an external or internal cause, disappearing with the disappearance of that cause, and which forms have been propagated and are being propagated *uniformly* through all the generations within the limits of our observation, and are yet most probably to be propagated during the existence of mankind, he is obliged to describe these two forms as distinct, and they will commonly be called species.

We have mentioned above that many points in the *life-history* of the Salmonoids still remain very obscure:—

1. Johnson, a correspondent of Willughby (Hist. Pisc. p. 194), had already expressed his belief that the different Salmonoids interbreed; and this view has since been shared by many who have observed these fishes in nature. Yet, no instance had been clearly made out, until we were enabled, through the liberality of the Rev. Augustus Morgan, to convince ourselves of the existence of a hybrid between the Sewin (*S. cambricus*) and the River Trout (*S. fario*). These hybrids are so numerous in the Rhymney and other rivers of South Wales, and so variable in their characters, that the passage from one species to the other may be demonstrated in an almost unbroken series; which might induce some naturalists to regard both species as identical. We have evidence sufficient, but of a less convincing character, of hybridism between *S. trutta* and *S. fario*. In some rivers the conditions appear to be more favourable to hybridism than in others, in which hybrids are of comparatively rare occurrence. We have never seen individuals which could with any certainty be regarded as hybrids between the Salmon and some other species; and although there are not a few examples in the Collection of the British Museum which indicate some affinity to the Salmon, they differ so much among themselves that they are evidently of different origin, and some of them may even eventually prove to be distinct species. The hybrids are sexually as much developed as the pure breed, but nothing whatever is known of their further propagation and progeny.

2. Siebold has shown that some individuals of every species are not sexually developed, and that such individuals differ also externally from those normally developed. However, he appears to have gone too far when he stated that this state of sterility extends over the whole period of existence of such individuals, and that therefore the external peculiarities also remain permanent throughout life. Widegren has shown that this sterility is merely a temporary immaturity, and that a part of the individuals arrive at a full sexual development at a later or much later period than others. To this we may add that many Salmonoids cease to propagate their species after a certain age, and that all so-called overgrown individuals (that is, specimens much exceeding the usual size of the species) are barren. Externally they retain the normal specific characters.

The Salmon offers a most remarkable instance of irregularity as regards the age at which the individuals arrive at maturity. Shaw has demonstrated, in the most conclusive manner, that those small Salmonoids generally called *Parr* are the offspring of the Salmon,

and that many males, from 7 to 8 inches long, have their sexual organs fully developed, and that their milt has all the impregnating properties of the seminal fluid of a much older and larger fish. That this Parr is not a distinct species—as has lately been again maintained by Couch—is further proved by the circumstance that these sexually mature Parrs are absolutely identical in their zoological characters with the immature Parrs which are undoubtedly young Salmon, and that no Parr has ever been found with mature ova*. But whether these Parr produce normal Salmon impregnating the ova of female Salmon, or mingle with the River-Trout, or whether they continue to grow, and propagate their species as true Salmon, are questions which remain to be answered. We may only add that, as far as we know, barren old Salmon must be extremely scarce; the only sterile example we know of is the specimen *hh* mentioned on p. 15.

3. The question whether any of the migratory species can be retained in fresh water, and finally accommodate themselves to a permanent sojourn therein, must be negatived for the present. Several instances of successful experiments made for this purpose have been brought forward; but all these accounts are open to serious doubts, inasmuch as they do not afford us sufficient proof that the young fish introduced into ponds were really young migratory Salmonoids, or that the full-grown specimens were identical with those introduced, and not hybrids or non-migratory Trout of a somewhat altered appearance in consequence of the change of their locality. We have seen the experiment tried at two places in South Wales, by the Rev. Augustus Morgan and by W. Peel, Esq., of Taliaris; and in both cases the Salmon and the pure Sewin died when not allowed to return to the sea. However, the latter gentleman pointed out to me that the hybrid fishes from the Sewin and the Trout survived the experiment, and continue to grow in a pond perfectly shut up from communication with the sea. In that locality neither these hybrids nor the trout spawn.

4. Although the majority of the mature individuals of a migratory species ascend a river at a certain fixed time before the commencement of spawning, others enter the fresh water at a much earlier period, either single or in small troops; and many appear to return to the sea before they reascend at the time of the regular immigration. It is not improbable that one and the same individual may change the salt for fresh water several times in the year. However, this is the case in certain rivers only—for instance, in those falling into the Moray Firth; in others one immigration only is known

* Some advocates for the opinion of the specific distinctness of the Parr pretend, indeed, to have found female Parrs. Those fish which were pointed out to me as females, were invariably specimens which had fed freely on the ova of their congeners, and their stomachs had been regarded as the ovary! Some persons were even so anxious to convince me of the correctness of their opinion, that they sent me specimens with ova in the abdominal cavity. On closer examination, these fishes turned out to be immature *male* specimens, the ova having been introduced by a cut into the abdomen said to have been made to admit the spirit!

to occur. The cause of these irregular ascents previous to the autumnal ascent is unknown. A part, at least, of the hybrid fishes retain the migratory instinct; but it is not known whether sterile individuals accompany the others on their migrations.

5. It is said that the migratory species invariably return to the river in which they were bred. Experiments have shown that this is normally the case; but a small proportion appear to stray so far away from their native place as to be unable to find their way back. Thus, several specimens of Sea-Trout, which have been caught with Sewin and Salmon in South Wales, differ so remarkably from any other species known to ourselves, that we cannot help thinking that they are stray individuals of a kind of Trout (see also p. 86) and from a locality unknown to us at present. Further, almost every year Salmon and Sea-Trout in the Grilse state make their appearance at the mouth of the Thames (where the migratory Salmonoids have become extinct for many years), ready to ascend and to restock this river as soon as its poisoned water shall be sufficiently purified to allow them a passage.

6. There has been much dispute about the time required for the growth of Salmonoids. The numerous and apparently contradictory observations tend to show that there is a great amount of variation even among individuals of the same origin living under the same circumstances, some of them growing much more quickly than others, and being ready to descend to the sea twelve months before their brethren. The cause of this irregularity is not explained. On the other hand, when we consider the fibrous condition of the Salmonoid skeleton, which is much less solid, and more wanting in calcareous substance, than that of the majority of Teleosteous fishes, we shall be quite prepared to adopt the truth of the observation that the young Salmonoids return to the fresh water after a few months' sojourn in the sea, and after having feasted on nourishing Crustaceans, Sand-eels, &c., with their former weight in ounces increased to pounds.

After these preliminary remarks we proceed to the enumeration of the species. We shall see that it is impossible to give the distinctive characters of a great proportion of the species, which are known from antiquated or popular descriptions only. In these cases the locality will be the best guide for recognizing the species. However, we can nearly always decide whether the fish is a Salmo proper, or whether it belongs to the Charr-group. Therefore, after having divided, with Nilsson, these fishes into those two groups, we arrange the species of each geographically.

First Subgeneric Group. SALMONES.

Truttæ, *Nilsson, Prodr. Ichth. Scand.* pp. 2 and 7.
Salar *et* Fario, *Cuv. & Val.*

Teeth not only on the head of the vomer, but also along its body; in a few species the posterior teeth are lost with age, and only a

more or less conspicuous ridge remains along the median line of the bone, which becomes visible after removal of the membrane.

A. *Species with a wide geographical range.*

1. Salmo salar.

Salmo, *Salvian.* p. 100; *Aldrov.* iv. p. 488.

We have had opportunity of comparing only British, French, Danish, and Dutch Salmon; and therefore we are obliged to rely on the authors who have determined the Salmon of other faunas as the *S. salar*, L. In not a few cases it is doubtful whether this determination is correct.

Synonymy of the Scandinavian Salmon.

Lax; Lohi *in Finland.*
Salmo, no. 1, *Artedi, Synon.* p. 22; and *Spec.* p. 48; *Linn. Faun. Suec.* p. 115.
Salmo, no. 2, *Artedi, Species*, p. 50 (*Laxunge*); young.
Salmo salar, *L. Syst. Nat.* i. p. 509: *Müll. Prodr. Zool. Dan.* p. 48; *Ekström, Fische in den Scheeren von Mörkö*, p. 186; *Nilss. Skand. Fisk.* p. 370; *Kröyer, Danm. Fisk.* ii. p. 540; *Wright & Ekström, Skand. Fisk.* taf. 58 & 59 (excl. fig. *b*); *Widegren, Öfvers. Vet. Akad. Förh.* xix. p. 541, taf. 4. figs. 3, 4 (parr) [not 1864, taf. 14. fig. 1].
—— salmulus, *Fries, Vet. Akad. Handl.* 1837, p. 1. tab. 1 (young).

Iceland Salmon.

Salmo nobilis, *Olafs. Isländ. Reise*, i. p. 83.
Salmo salar, *Mohr, Isländ. Naturh.* p. 74; *Faber, Fische Islands*, p. 156.

Russian Salmon.

Salmo nobilis, *Pallas, Zoogr. Ross.-Asiat.* iii. p. 342.
—— salar, *Nordm. Faun. Pont.* p. 515.

German Salmon.

Lachs, Salm.
Salmo, *Schonev.* p. 64; *Gesner, De Aquat.* p. 969.
Salmo salar, *Bloch*, i. p. 128, taf. 20 (fem.), and iii. p. 146, taf. 98 (male); *Siemssen, Fische Mecklenb.* p. 51; *Hartm. Helvet. Ichthyol.* p. 87; *Agass. Poiss. d'eau douce*, pl. 1 (male), pl. 1*a* & 1*b* (fem.), pl. 2 (fem.); *Günth. Fische des Neckars*, p. 111; *Heckel & Kner, Süsswasserfische*, p. 273, c. fig. mediocri; *Siebold, Süsswasserfische*, p. 292.
Skeleton: Rosenthal, Ichthyotom. Taf. t. 6; Bruch, in Abhandl. Senckenb. ntrf. Gesellsch. 1862, iv. pp. 73–130; and Vergleichende Osteologie des Rhein-Lachses mit besonderer Berücksichtigung der Myologie. Mainz, 1861. Fol. (with seven plates).

French Salmon.

Saumon, Beccard.
Salmo, *Bellon. De Aquat.* i. p. 277, c. fig. cap. mar.; *Rondel. De Pisc. fluv.* p. 167.

Saumon, *Duhamel, Pêches*, ii. p. 192, pl. 1. figs. 1 & 2.
Salmo salmo, *Cuv. & Val.* xxi. p. 169, pl. 614 (half-grown).
—— hamatus, *Cuv. Règne Anim.*; *Cuv. & Val.* xxi. p. 212, pl. 615; *Heckel & Kner, Süsswasserfische*, p. 276 (old male, *Bécard*).

Galician Salmon.

Cornide, Essayo de los peces de Galicia, p. 75.

British Salmon.

Parr, Pink, Smolt: young of first and second year. Grilse, Salmon-peal: on first return from sea. Kelt: after spawning. Kipper: male after spawning. Shedder, Baggit: female after spawning.

Salmo, *Will. Hist. Pisc.* p. 189, tab. N. 2. figs. 1 & 2 (cop. Salvian.).
Salmon, *Pennant, Brit. Zool.* iii. p. 249, pl. 58, and edit. 1812, iii. p. 382, pl. 69; *Couch, Fish. Brit. Isl.* iv. p. 163, pl. 211; *Russel, A. The Salmon*, Edinb., 1864, 8vo.
Salmo salar, *Turton, Brit. Faun.* p. 103; *Fleming, Brit. An.* p. 179; *Jardine, in Edinb. New Phil. Journ.* viii. p. 46, and *Brit. Salmon*, pls. 1, 2, & 8 (Grilse), and pl. 7 (male); *Richards. Faun. Bor. Amer. Fishes*, p. 140, pl. 91. fig. 1 (head); *Jenyns, Man.* p. 421; *Yarrell, Brit. Fish.* 2nd edit. ii. p. 1, 3rd edit. i. p. 155 (figures of doubtful value); *Parnell, Fishes of the Firth of Forth*, p. 118, pl. 32. figs. 1 & 2 (adult), pls. 30 & 31 (smolts).
Salmo hucho, *Couch in the Twenty-seventh Annual Report of the Cornwall Polytechnic Society*, 1859, p. 14.
—— gracilis, *Couch, Fish. Brit. Isl.* iv. p. 216, pl. 216 (very bad*).
Salmulus†, *Ray, Syn. Pisc.* p. 63.
Samlet and Parr†, *Penn. Brit. Zool.* iii. p. 303, pls. 59 & 66, and ed. 1812, iii. p. 404, pls. 70, 77; *Yarrell, Brit. Fish.* 2nd edit. ii. p. 83; *Couch, Brit. Fish.* iv. p. 245, pl. 221.
Salmo salmulus†, *Turton, Brit. Faun.* p. 104; *Jardine, Edinb. New Phil. Journ.* xviii. p. 56; *Jen. Man.* p. 426; *Parn. Wern. Mem.* vii. p. 298, pl. 30, or *Fish. Firth of Forth*, p. 138, pl. 30.
Development: Shaw, Experimental Observations on the Development and Growth of Salmon-fry. In Trans. Roy. Soc. Edinb. vol. xiv., and in Edinb. New Philos. Journ. 1836, July, and 1838, January.

North American Salmon.

Salmon, *Pennant, Arctic Zool.* ii. p. 392.
Salmo salar, *Mitchill, Fish. of New York*, p. 434; *Richards. Faun.*

* The original specimen from which this figure was taken is fortunately preserved in the British Museum, to which it has been kindly given by Mr. Couch. It is in a very good state of preservation. Without this, one might have been easily induced to consider Mr. Couch's *S. gracilis* allied to those American Salmonoids which have the anal fin prolonged. However, it is nothing but a Salmon, in which neither is the head so small or of the peculiar appearance with which it is represented by Mr. Couch, nor has the anal fin the number of rays increased. We need not add that neither the form of the head nor the number of anal rays could be so changed by the process of preservation as to explain the discrepancies between the original specimen and the figure given by Mr. Couch.

† Under these names the young not only of the Salmon, but also of other Salmonoids have been described.

Bor.-Amer. Fishes, p. 145; *DeKay, Fish. of New York*, p. 241, pl. 38. fig. 122; *Storer, Synopsis of the Fishes of North America*, p. 192.

B. 11–12. D. 14. A. 11. P. 14. V. 9. L. lat. 120. L. transv. $\frac{22}{19}\frac{26}{22}$. Vert. 59 (60, *Rosenthal*). Cæc. pyl. 53–77 (*m.*), 63–68 (*Richards.*), 60–67 (*Valenc.*).

Attaining to a length of from four to five feet; female mature at a length of about fifteen inches.

Head rather low; the operculum somewhat produced, its length contained in its depth once and two-fifths in large examples, once and one-fourth in halfgrown ones, and once and one-fifth in young ones. The posterior point of junction of operculum and suboperculum is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum with a distinct lower limb, and with the angle rounded (see woodcut, p. 6). Snout much produced in the male, and the lower jaw with a strongly curved prominence during the spawning-season*; maxillary as long as, or shorter than the snout in specimens above 20 inches in length; it extends to below the posterior margin of the orbit, but only to below the middle of the eye in the Parr-state; it is slender and rather feeble in mature examples, but stout and broad in young ones. The head of the vomer subpentagonal, as long as broad, toothless; the body of this bone with a single series of small teeth, which at an early age are gradually lost from behind towards the front, so that half-grown and old examples have only a few (from one to four) left. The caudal fin is deeply cleft in young examples, in which the longest rays are more than twice as long as the middle ones, and it remains forked or distinctly emarginate in specimens of 28 inches in length; it is truncate only in very large examples during or after spawning. The hind part of the body is elongate, and covered with relatively large scales, *there being constantly eleven or sometimes twelve in a transverse series* running from behind the adipose fin obliquely forwards to the lateral line.

Young with about eleven dusky cross bars; halfgrown and old specimens silvery, with small black spots in small number; spawning males with numerous large black and red spots, some of the red spots confluent into more or less extensive patches, especially on the belly.

A migratory species, inhabiting temperate Europe to 43° N. lat., not found in the rivers falling into the Mediterranean, appears to extend southwards to the Bay of Biscay. The same species is said to inhabit northern Asia and America to 41° N. lat.

* In old males this hook is often one inch long or even longer, perforating the upper jaw between the intermaxillaries. It is generally believed that this hook is absorbed again after the Salmon has returned to the sea. However it is more probable that the observation made by Steller, Pallas, Richardson, and others, according to which old examples of Salmonoids of Kamtschatka and North-western America perish after the efforts of propagation, also holds good with regard to European Salmons of the age and condition indicated. A number of such "kelted" Salmon are found dead in every Salmon-river; and probably those which reach the sea alive perish there.

British Specimens.

a. Male, 46 inches long, in spirits. River Tay. Purchased. This specimen weighed 46 pounds, and was caught in the month of July, being in the most perfect condition.

b. Male, 43 inches long, stuffed. Old Collection. This specimen was evidently captured after the breeding-season; the hook of the lower jaw has perforated the upper.

c. Male, 41 inches long, taken whilst in the highest condition, stuffed. River Annan, Dumfriesshire. Presented by J. Gould, Esq.

d. Head of a large male fish, with deformed snout. Worcester.

e. Male, 37½ inches, in spirits. Fermanagh, Ireland. Presented by the Earl of Enniskillen. Caught in the beginning of November, showing the appearance of a specimen immediately after spawning.

f. Female, 28 inches, stuffed. River Dart, South Devonshire. Presented by Lieut. H. F. Spence, R.N.

g. Male, 28½ inches, skin. River Tamar, near Plymouth. Caught in December; cæc. pylor. 51. From Mr. Yarrell's Collection.

h. Female, 28½ inches, stuffed. Polperro. Type of *Salmo gracilis*, Couch.

i. Fine female specimen, 25½ inches. Rhymney, Monmouthshire. Presented by the Rev. Chancellor Aug. Morgan.

k. Twenty-four inches and a half, skin. Firth of Forth. From Mr. Parnell's Collection. Original of fig. 2, on tab. 32 of the 'Fish. Firth of Forth' (Norway Salmon).

l–q. Skins. Firth of Forth. From Mr. Parnell's Collection.

r–z. Skins. British Islands. From Mr. Yarrell's Collection.

α. Male, 11½ inches, skin. Solway Firth. From Mr. Yarrell's Collection. Caught June 8th. "The smallest Salmon Yarrell has ever seen that had been to salt-water".

Smolts.

β, *γ*. Nine inches and a half and 7½ inches, skins. River Eden. From Mr. Yarrell's Collection.

δ. Eight inches, in spirits. Scotland. Purchased of Mr. Stevens.

ε. Many specimens, 5–7 inches long, in spirits. Tweed, May 1st. Presented by his Grace the Duke of Roxburgh.

ζ. Many specimens, 5–6 inches, in spirits. Rhymney, April 1st and 15th. Presented by the Rev. Chancellor Augustus Morgan.

η. Five inches, in spirits. Tweed, May 12th.

Parr.

θ–κ. From 3 to 8 inches, in spirits. River Torridge, Devon. Presented by Dr. A. Günther.

λ–ξ. From 4 to 5 inches, in spirits. River Bovey, Devon.

o. Many specimens, from 6 to 7 inches, skins. R. Plym. From Mr. Yarrell's Collection; and Presented by Lieut. H. F. Spence, R.N.

π. Five inches and a half, skin. River Sark, Yorkshire. From Mr. Parnell's Collection.

ρ. From 5½–6½ inches, skins. River Swale, Yorkshire. From Mr. Parnell's Collection.

σ. Five inches and a half, skins. River Esk, Cumberland, From Mr. Parnell's Collection (*S. salmulus*); caught in the month of August.

τ–φ. From 6 to 7½ inches, in spirits. River Kulder, Northumberland. Presented by his Grace the Duke of Northumberland. Vernacular name, *Rack-sliders*; males with the milt matured.

ψ. Many specimens, 5–6 inches, in spirits. Tweed. Presented by his Grace the Duke of Roxburgh.

ω. A great number of skins, from 4 to 7 inches long. River Tweed. From Mr. Parnell's Collection.

aa. Five inches and a half, in spirits. Berwick, month of May.

bb. Two inches and three-quarters, in spirits. Firth of Forth.

cc. From 4½ to 6 inches, skins. North Esk River, Forfarshire. From Mr. Parnell's Collection; partly as *S. salmulus*, partly as *S. salar*.

dd. From 4 to 6 inches, in spirits. Scotland. Purchased of Mr. Stevens.

ee. Four inches and a half, skin. From Mr. Yarrell's Collection, "St. John's beck."

ff. Fry, 1 inch long, without umbilical sac. Tweed, month of May.

CONTINENTAL SPECIMENS.

gg. Male, 37 inches long, stuffed. Calais. Presented by Captain Baker Bridge.

hh. Female, 36 inches long. Denmark. Presented by the Copenhagen Museum. This specimen is of great interest, as, although apparently caught in the month of November, the ova are not developed, and only of the size of a millet-seed; it is a barren individual, externally not differing from a normally developed Salmon. It was caught in the sea, as its stomach contained a half-digested herring. Cæc. pyl. 77.

ii. Head of an adult specimen. River Nid near Arendal, Norway. Presented by Prof. N. St. Maskelyne.

NORTH AMERICAN SPECIMENS.

kk–mm. Dried heads of adult males and females.

OSTEOLOGY.

oo–pp. Skulls of adult females. Rhine. From Dr. A. Günther's Collection.

qq. Skull of an adult male. Berlin.

rr. Skeleton of an adult male. River Severn. Presented by F. Allies, Esq.

THE diagnosis given above will contain nearly all the characters by which the European Salmon may be distinguished from the other

species known to us. The following descriptions will be of use for comparison of specimens of a certain size and state of development.

Description of a Male Salmon from the Tweed, 46 inches long.

	inches.
Total length	46
Greatest depth of the body	11½
Length of the head	10½
Girth of the biggest part of the body	28
Least depth of the tail	3⅓
Girth of the narrowest part of the tail	10
Distance between the end of the snout and the eye	4½
Length of the maxillary bone	3¾
Distance between the eye and the angle of the præoperculum	3⅓
Greatest width of the operculum	2⅓
Greatest depth of the operculum	3
Distance between the occiput and the origin of the dorsal fin	14
Distance between the end of the dorsal and the root of the caudal fin	15
Length of the base of the dorsal	4⅔
Greatest height of the dorsal	4½
Length of the pectoral	5½
Distance between the root of the pectoral and the root of the ventral	12½
Length of the ventral fin	4⅔
Distance between the root of the ventral and the origin of the anal	10½
Length of the anal	3⅓
Greatest depth of the anal	4½
Length of the longest caudal ray	6

The specimen is in the most perfect condition; the scales are not sunk into the skin, but perfectly and regularly imbricate, although the greater portion of each of the dorsal scales is covered by the basal membrane. The greatest depth of the body is below the origin of the dorsal fin, and a little more than two-sevenths of the total length (the caudal fin not included); the length of the head is one-fourth of the same. The snout is produced, but its length is somewhat less than that of the post-orbital portion of the head; the hook of the lower jaw is moderately developed, its cartilaginous point being only one-third of an inch in length; however, it prevents the mouth from being shut, and the finger can easily pass between the jaws when closed; the maxillary bone is considerably shorter than the snout, and extends scarcely beyond the vertical line from the posterior margin of the orbit, the width of its broadest part is less than the diameter of the eye. The dentition of the jaws and of the palatine bones is almost perfect, the teeth of the intermaxillary being rather stronger than those of the mandible,

which, again, are larger than the maxillary and palatine teeth: of the vomerine teeth only two of the anterior ones are left.

The distance of the nostrils from the orbit is nearly equal to the diameter of the latter: the interorbital space is very convex, the orbit being far below the upper profile of the head; its width equals the length of the maxillary bone or the distance between the pupil and the angle of the præoperculum. The posterior margin of the operculum and suboperculum is subsemicircular; when we fix three points on this curved line, viz. the upper end of the gill-opening, the junction of the operculum and suboperculum, and the lower end of the suboperculum, and when we connect these three points by two cords, the two straight lines are nearly equal.

The distance of the origin of the dorsal fin from the occiput is almost equal to its distance from the adipose fin. It is rather longer than high, and composed of thirteen rays, the two anterior ones being rudimentary and enveloped in skin, whilst the third is simple, and nearly as long as the fourth, which is branched and the longest ray of the fin. The anal fin is higher than long, and composed of eleven rays, the two anterior ones being rudimentary and hidden in thick skin, whilst both the third and fourth rays are branched, and the longest: the last is split to its base. Pectoral fin nearly as long as the head without snout; ventral fin shorter, its length being one half of the distance of its root from the vent; its outer ray is in the vertical from the middle of the dorsal fin. Posterior margin of the caudal fin truncated.

There are 120 transverse series of scales, counted immediately above the lateral line: the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-five scales, and there are twenty longitudinal series of scales between the lateral line and the base of the ventral.

The lateral and lower parts are uniform silvery. The back is sparingly covered with black spots, which are limited to the membrane between the scales, none of them being larger than a scale. A single round black spot on the operculum. Fins immaculate.

Description of a Male Irish Salmon, caught in the month of November, during the Spawning-season, 36½ inches long.

	inches.
Total length	36½
Greatest depth of the body	8½
Length of the head	9½
Girth of the biggest part of the body	19
Least depth of the tail	2½
Girth of the narrowest part of the tail	7
Distance between the end of the snout and the eye	4½
Length of the maxillary bone	3½
Distance between the eye and the angle of the præoperculum	3

	inches.
Greatest width of the operculum	$2\frac{1}{8}$
Greatest depth of the operculum	$2\frac{5}{8}$
Distance between the occiput and the origin of the dorsal fin	$10\frac{1}{2}$
Distance between the end of the dorsal and the root of the caudal fin	11
Length of the base of the dorsal	$3\frac{5}{8}$
Greatest height of the dorsal	$3\frac{3}{4}$
Length of the pectoral	$4\frac{1}{2}$
Distance between the root of the pectoral and the root of the ventral	$9\frac{1}{2}$
Length of the ventral fin	$3\frac{3}{4}$
Distance between the root of the ventral and the origin of the anal	$6\frac{1}{2}$
Length of the anal fin	2
Greatest depth of the anal	3
Length of the longest caudal ray	$4\frac{3}{4}$

The specimen is out of condition, and had evidently finished the work of propagating its species. The skin over the whole of the body, and especially on the back and along the root of the fins, is much thickened and fungous, so that only the apex of the scales remains visible. The greatest depth of the body is below the origin of the dorsal fin, and one-fourth of the total length (the caudal fin not included). The head is long, rather more than two-sevenths of the total length, the snout being so much elongated that the eye occupies exactly the middle of the distance between the end of the snout and the operculum; the hook of the lower jaw is so much developed that the bony and cartilaginous part together form a complete semicircle; the cartilaginous part is one inch long: a deep hollow in the upper jaw receives the hook; however, the mouth cannot be completely shut, and the finger can easily pass between the jaws when closed. The maxillary bone is shorter than the snout, and extends scarcely beyond the vertical from the posterior margin of the orbit, the width of its broadest part is less than the diameter of the eye.

The dentition of the jaws and of the palatine bones is almost perfect; the teeth of the intermaxillary being stronger than those of the mandible, which again are larger than the maxillary and palatine teeth: the series of intermaxillary teeth does not extend across the fore part of the snout, the intermaxillary bones themselves being separated by a deep notch. Of the vomerine teeth three only of the anterior ones are left, they form a triangle: most of the teeth of the tongue are lost.

The distance of the nostrils from the orbit equals the diameter of the latter; the interorbital space is very convex, the orbit being far below the upper profile of the head; its width is less than the length of the maxillary bone, and equal to the distance between the eye and the angle of the præoperculum. The posterior margin of the

operculum and suboperculum is subsemicircular; when we fix three points on this curved line, viz. the upper end of the gill-opening, the junction of the operculum and suboperculum, and the lower end of the suboperculum, and when we connect these three points by two cords, the two straight lines are equal.

The distance of the origin of the dorsal fin from the occiput is a little less than its distance from the adipose fin. It is nearly as long as high, and composed of thirteen rays, which are enveloped in a thick callous skin. The anal fin is higher than long, and composed of eleven rays, which have been more or less injured through the exertions of the fish. Pectoral fin nearly as long as the head without snout, considerably longer than the ventral, the length of which is three-fifths of the distance of its root from the vent. Posterior margin of the caudal truncate.

There are 120 transverse series of scales; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-six scales; and there are twenty-two longitudinal series between the lateral line and the base of the ventral fin.

Upper parts blackish dark green; sides more whitish; belly reddish. The supraorbital region, the operculum, and the upper parts of the body are marked with black spots, broadly edged with pearl-colour; some on the body are half as large as the eye, but they are not very numerous. There are a number of purple vermiculated lines between the black spots; and similar markings, but of a blood-red colour, occupy the base of the caudal and some parts of the belly. The outer half of the caudal is greenish black.

Description of a Male specimen caught in the Firth of Forth, 22 inches long.

	inches.
Total length	22
Greatest depth of the body	$3\frac{3}{4}$
Length of the head	4
Girth of the biggest part of the body	10
Least depth of the tail	$1\frac{3}{4}$
Girth of the narrowest part of the tail	$4\frac{1}{8}$
Distance between the end of the snout and the eye	$1\frac{1}{2}$
Length of the maxillary bone	$1\frac{1}{2}$
Distance between the eye and the angle of the præoperculum	$1\frac{3}{8}$
Greatest width of the operculum	1
Greatest depth of the operculum	$1\frac{1}{4}$
Distance between the occiput and the origin of the dorsal fin	$6\frac{1}{2}$
Distance between the end of the dorsal and the root of the caudal fin	$7\frac{1}{2}$
Length of the base of the dorsal	$2\frac{1}{8}$

	inches.
Greatest height of the dorsal	2
Length of the pectoral	$2\frac{5}{8}$
Distance between the root of the pectoral and the root of the ventral	6
Length of the ventral fin	$2\frac{1}{8}$
Distance between the root of the ventral and the origin of the anal	4
Length of the anal fin	$1\frac{3}{8}$
Greatest depth of the anal	2
Length of the longest caudal ray	$3\frac{1}{8}$
Length of the middle caudal ray	$1\frac{5}{8}$

The depth of the body is contained five times and one-fourth in the total length (without caudal), the length of the head four times and two-thirds. The head is longish, with the snout slightly produced and conical; however, the snout is not so much elongate as to equal in length the postorbital portion of the head, the eye being situated entirely in its anterior half. The bones of the jaws are rather feeble, and especially the maxillary is rather thin in its upper portion, and only slightly dilated behind; it extends scarcely to below the posterior margin of the orbit, and is as long as the snout. (In a female specimen of the same length the snout is conspicuously shorter than in the male which we here describe, and the maxillary is decidedly longer than the snout.) The lower jaw is bent upwards in a slight hook, which does not prevent the mouth from being completely shut. The vomer is only anteriorly armed with two or three teeth, the remainder being lost; the posterior margin of the operculum and suboperculum is subsemicircular, and the point of junction of the two bones is equally distant from the upper end of the gill-opening and from the lower end of the suboperculum. Although the angle of the præoperculum is rounded, a horizontal limb can be distinguished, as well as a vertical one.

Dorsal fin rather longer than high. Anal fin considerably higher than long. The caudal fin is still deeply emarginate, the length of the middle rays being not much less than one-half of the length of the longest. Pectoral fin as long as the head without snout. Ventral half as long as its distance from the vent.

There are 120 transverse series of scales; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-five scales, and there are nineteen longitudinal series between the lateral line and the base of the ventral fin.

Upper parts greenish, which colour gradually passes into the silvery hue of the belly. There are some scattered X-shaped black spots on the side of the back above the lateral line. The colour appears to sit more in the membrane forming the pouches of the scales than in the scales themselves. Dorsal, caudal, and extremity of the pectoral blackish.

Description of a young Male Salmon (Parr) from the Kulder (a rocky mountain-stream joining the River Tyne, in Northumberland), with the testicles fully developed, 6½ inches long.

	inches.
Total length	6½
Greatest depth of the body	1 7/16
Length of the head	1⅜
Girth of the biggest part of the body	3½
Least depth of the tail	9/16
Girth of the narrowest part of the tail	1¼
Distance between the end of the snout and the eye	⅜
Length of the maxillary bone	7/16
Distance between the eye and the angle of the præoperculum	⅜
Greatest width of the operculum	⅜
Greatest depth of the operculum	7/16
Distance between the occiput and the origin of the dorsal fin	1⅝
Distance between the end of the dorsal and the root of the caudal fin	2 1/16
Length of the base of the dorsal	⅝
Greatest height of the dorsal	⅝
Length of the pectoral	1¼
Distance between the root of the pectoral and the root of the ventral	1⅝
Length of the ventral fin	⅞
Distance between the root of the ventral and the origin of the anal	1
Length of the anal	9/16
Greatest depth of the anal	¾
Length of the longest caudal ray	1 1/16
Length of the middle caudal ray	7/16

The greatest depth of the body is below the origin of the dorsal fin, and contained thrice and two-thirds in the total length (without caudal), the length of the head being one-fourth of it. The snout is obtuse, not longer than the diameter of the eye, which is one-fourth of the length of the head; the dentigerous margin of the intermaxillary bones is on the same level with the lower margin of the orbit; the lower jaw has no trace of a hook, is obtusely rounded in front, and received within the upper jaw; the maxillary bone is longer than the snout, dilated behind as in a river-trout, the width of its broadest portion being one-half of the diameter of the eye; it extends backwards to below the middle of the orbit. The dentition is perfect, and there is the same relative difference in the size of the teeth as in adult specimens; the teeth of the intermaxillary bones form a curved, uninterrupted, transverse series; those on the vomer are small, in a single series, extending further backwards than the palatine teeth, the teeth being alternately bent towards the

right and left; three or four small teeth form a very short transverse series on the front part of the vomer.

The distance of the nostrils from the orbit is only one-third of the diameter of the latter; the interorbital space is flattish, with an obtusely prominent median longitudinal ridge, and its width equals the diameter of the eye. The posterior margin of the operculum and suboperculum is angularly bent, the angle itself being rounded; the point of junction of these two bones is midway between the upper end of the gill-opening and the lower end of the suboperculum. The angle of the præoperculum is more obtusely rounded than in adult specimens.

The distance of the origin of the dorsal fin from the occiput is considerably more than its distance from the adipose fin; it is higher than long, and composed of fourteen rays, the three anterior ones being rudimentary, the fourth simple, not quite as high as the fifth, which is branched and nearly as long as the sixth, which forms the highest point of the fin. The anal fin is higher than long, and composed of eleven rays, the first being rudimentary, the second simple, nearly as long as the third, which is branched, the fourth and fifth being the longest rays of the fin. Caudal fin deeply forked, its middle rays being not quite half as long as the lobes. The length of the pectoral fin equals the distance of the end of the gill-cover from the nostrils. Ventral fin much shorter, terminating at a short distance from the vent; the outer ventral ray is in the vertical from the middle of the dorsal fin.

There are 120 transverse series of scales counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-two scales; and there are twenty longitudinal series of scales between the lateral line and the base of the ventral.

The upper parts are uniform brownish olive, each scale shining silvery. Lower parts entirely silvery. There are eleven dusky transverse bars on each side of the body, across the lateral line; they are rather wider than the interspaces. Back with scattered small black spots, the number of which is very variable; there is constantly a round, deep-black spot, as large as the pupil, in front of the middle of the operculum; and another similar spot generally occupies the posterior end of the suture between the operculum and suboperculum. Dorsal fin with large, irregular, black interradial spots, and with a narrow whitish antero-superior edge. Caudal uniform blackish. Posterior half of the pectoral blackish. Ventral and anal whitish, the latter with a bright, yellowish white, antero-inferior edge.

2. Salmo trutta.

Synonymy of Scandinavian specimens.

Laxöring, Örlax, Tajmen.

? Salmo no. 5, *Artedi, Synon.* p. 24; no. 3, *Genera*, p. 12, and *Species*, p. 51. (Description very short and insufficient.)

Salmo no. 308, *L. Faun. Suec.* p. 116.
? ? Salmo trutta, *L. Syst. Nat.* i. p. 509*.
Salmo trutta, *Nilss. Skand. Faun. Fisk.* p. 406; *Kröyer, Danm. Fisk.* ii. p. 582.
—— truttula, *Nilss. Prodr.* p. 5.
—— eriox, *Kröyer, Danm. Fisk.* ii. p. 602.

German specimens.

See-Forelle, Lachs-Forelle.
Trutta salmonata, *Schonev. Ichthyol.* p. 65.
Trutta no. 1, *Klein, Pisc. Miss.* v. p. 16, tab. 1. fig. 1.
Salmo trutta, *Bloch, Naturgesch. Fische Deutschl.* i. p. 143, taf. 21 (this figure does not represent the Sea-trout; it resembles much more a variety of *S. fario* than the Sea-trout); *Sélys-Longchamps, Faune Belge*, p. 221; *Siebold, Süsswasserfische*, p. 314.
Salmo goedenii, *Bloch*, p. 135, taf. 102 (young).

Russian specimens.

? Salmo spurius, *Pall. Zoogr. Ross.-As.* iii. p. 343.

British specimens.

Sea-trout; Salmon-trout (Bull-trout†).
Grisle-state: Phinok, Herling, Hirling; Lammasmen (*Edinburgh*).
Trutta salmonata (The Scurf), *Johnson, in Willughby*, p. 193; *Ray, Synops.* p. 63.
White, *Penn. Brit. Zool.* iii. p. 264, and ed. 1812, iii. p. 396.
Salmo cumberland, *Lacép.* v. p. 696.
? Salmo albus, *Walb. Art. Renov.* iii. p. 75; *Bl. Schn.* p. 409; *Lacép.* v. p. 219; *Flem. Brit. An.* p. 180; *Jardine, in Edinb. New Philos. Journ.* xviii. p. 50.
? Salmo phinok, *Turton, Brit. Faun.* p. 103.
Salmon-trout, *Richards. Faun. Nor. Amer. Fishes*, p. 140, pl. 92. figs. 1 A & B (very good); *Couch, Fish. Brit. Isl.* iv. p. 214 (pl. 215?).
? Herling, *Jardine, in Proc. Berwicksh. Nat. Club*, ii. p. 50.
Salmo trutta, *Flem. Brit. An.* p. 180; *Jenyns, Brit. Vert.* p. 423; *Jardine, Salmon*, pl. 11 (young), pl. 3 (half-grown) (not good), pl. 10 (the central figure is probably taken from a different species), pl. 9 (adult); *Yarrell, Brit. Fish.* 2nd edit. ii. p. 77; 3rd edit. i.

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* Although Linnæus meant to introduce the Swedish *Örlax* or *Börting* into the system with the name of *Salmo trutta*, the fish from which he took his diagnosis is evidently very different from the migratory species commonly called *S. trutta*; it had *ocellated* spots, a double series of vomerine teeth, is more frequent in Dalekarlia and Nordland, and attains to a length of 2 feet. This was probably a non-migratory species.

† No distinct species is designated by this name; at all events the name is applied to different species at different localities, and by different persons. We have received numerous examples of *S. trutta* under this denomination; I have also seen stuffed examples of "Bull-trout," each of them of a peculiar aspect, but without any characters by which the species could be determined. It would appear that many examples somewhat differing in general aspect from *S. trutta* are named "Bull-trout."

p. 250 (descr. part); *Parnell, Fish. Firth of Forth*, p. 133, pl. 34. f. 11; *Jardine, in Edinb. New Phil. Journ.* xviii. p. 49.

Salmo hucho (l), *Flem. Brit. An.* p. 179.

Salmo eriox, *Parnell, Fish. Firth of Forth*, p. 128, pls. 32–34; *Fleming, Brit. Anim.* p. 180.

[*Couch's* Sea-trout, at least the figure (pl. 214), appears to have been a variety of the common Trout, or a hybrid between Trout and Sewin.]

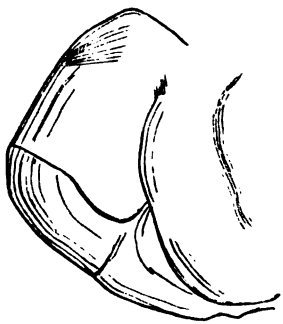
Osteology.

Salmo eriox, *Owen, Catal. Osteol. Ser. Coll. Surg.* i. 1853, p. 16 (detailed description of skeleton).

B. 11. D. 13. A. 11. P. 15. V. 9. L. lat. 120. L. transv. $\frac{24-26}{36-34}$.
Vert. 59–60. Cæc. pyl. 49–61, rarely less.

Attaining to a length of about 3 feet; female mature at a length of from 10 to 12 inches.

Head rather short, compared with its depth; operculum short, its length being contained in its depth from once and three-fifths to twice; like the other bones of the skull, it is thin, and in dried specimens there are several concentric striæ near to and parallel with its hinder margin. The hind margin of the gill-cover is obtusely rounded,



with the suboperculum scarcely projecting beyond the end of the opercle. The posterior point of junction of operculum and suboperculum is generally nearer to the lower anterior angle of the suboperculum, than to the upper end of the gill-opening. Præoperculum with a distinct lower limb, with the angle rounded, and with the hind margin convex. Snout rather short, moderately produced in full-grown males [lower jaw hooked during the spawning-season]; maxillary longer than the snout, extending to below the posterior margin of the orbit in adult examples, and to behind the middle of the eye in specimens 6 inches long (Parr-state); it is always rather slender and feeble, and with longitudinal ridges in dried examples. Head of the vomer triangular, as broad as long, toothless; body of this bone with a longitudinal ridge, armed with a single series of teeth, some of which are bent outwards; the greater part of these teeth are lost at various ages, so that sometimes only three or four are left in specimens 12 inches long, whilst other much older examples of 20 inches sometimes show six or eight; generally only the two or three anterior ones are found in examples of more than 20 inches in length.

Fins short, especially pectoral and caudal.

The caudal fin is cleft in young examples, in which the longest rays are not quite twice as long as the middle ones; it is generally

square in specimens of from 18 to 20 inches; but rare examples occur, of 25 inches in length, in which this fin continues to show a slight emargination. Tail not elongate, covered with thin, short, rounded scales, like the body; there are fourteen or fifteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.

Young with nine or ten dusky cross bars, half-grown ones (Grilse-state) with the top of the dorsal and pectoral, and with the hind margin of the caudal black. Silvery, sometimes immaculate, generally with more or less numerous X-like spots; spots on the head and dorsal fin round, and readily disappearing.

The interneural spine of the first long dorsal ray is attached to the neural of the seventeenth vertebra.

A migratory species, occurring in the rivers falling into the Baltic and German Ocean; numerous in Scotland, but less widely distributed in English and Irish rivers.

a. Head of a very large male specimen (10 inches long). Tweed. Presented by Lord Ravensworth.

b. Male, 35 inches long. Tweed. Presented by His Grace the Duke of Roxburgh.—Caught at the end of October; ready for spawning; cæc. pyl. 43.

c–d. Females. Tweed. Presented by His Grace the Duke of Roxburgh.—One, 28 inches long, caught in the month of December, during spawning; cæc. pylor. 46. The other, 24 inches long, caught in the month of January, after spawning; cæc. pylor. 59.

e–f. Male and female, 18½ and 20 inches long. Tweed. Presented by His Grace the Duke of Roxburgh. "Sea-trout." Cæc. pyl. 58 and 60.

g–h. Male and female, 20 and 21 inches long. Tweed. Presented by His Grace the Duke of Roxburgh. "Bull-trout." Cæc. pyl. 45 in the male, and 59 in the female.

i. Female, 17 inches long. Tweed. Presented by Mr. G. Smith.—This specimen had been marked with copper-wire in the right under jaw in April 1864, when it was in the state called "Orange-fin," and was recaptured on its return from the sea, August 1865.

k–l. Females, 14 inches long. Tweed. Presented by His Grace the Duke of Roxburgh. "Whitting." Caught at the end of April. Cæc. pyl. 49.

m–n. Twelve inches long. Tweed. Presented by Mr. G. Smith.—"Black-tails." Caught at the end of October.

o–t. "Bull-trout-smolts," 7 inches long. Tweed. Presented by His Grace the Duke of Roxburgh.—Caught at the end of April, when running down to the sea.

u–x. "Bull-trout-Parr," locally called "Orange-fins," from 4 to 6 inches long. Tweed. Presented by His Grace the Duke of Roxburgh; caught in April.

y. Male, stuffed; 38 inches long. Portinlik (Sutherlandshire). Presented by Sir Ph. Egerton. M.P.

z. Female, 18 inches long. "Montrose Trout." Caught in April.

a. Female, 20 inches long. Dhu Loch, Argyleshire. Presented by His Grace the Duke of Argyle. "Bull-trout." Taken in the beginning of September; ova nearly fully developed; cæc. pyl. 49.

β. Male, 20 inches long. Purchased in the London market in April. —Cæc. pyl. 52.

γ–δ. Male and female, 20 inches long. River Ouse. Presented by Major H. Scott.—Taken in the month of October; nearly ready to spawn; male with a long hook; cæc. pyl. 49.

ε. Several specimens in the Grilse-state. River Eden; caught in October. Purchased of Mr. Wright.—Cæc. pyl. 49; Vert. 59.

ζ. Twenty-seven inches: skin, female. Firth of Forth. Type of Parnell's "Salmon-spotted Bull-trout," p. 131, pl. 32. fig. 4.—Cæc. pyl. 54.

η. Twenty-five inches: skin, female. Firth of Forth. Type of Parnell's "Few-spotted Bull-trout," p. 131, pl. 33. fig. 5.—Cæc. pyl. 55.

θ. Twenty-seven inches: skin, female. Firth of Forth. From Mr. Parnell's Collection.

ι. Twenty-six inches and a quarter: skin, male. Firth of Forth. Type of Parnell's "Largeheaded Bull-trout," p. 132, pl. 33. fig. 7.—Cæc. pyl. 50.

κ. Twenty-five inches: skin, female. Firth of Forth. Type of Parnell's "*Salmo trutta*, Salmon-trout," p. 133, pl. 34. fig. 11. —Cæc. pyl. 51.

λ. Twenty-one inches and a half: skin, female. Firth of Forth. Type of Parnell's "Norway Bull-trout," p. 133, pl. 34. fig. 10. —Cæc. pyl. 52.

μ. Twenty-two inches: skin, female. Solway. From Mr. Parnell's Collection.

ν. Twenty-one inches: skin. Firth of Forth. One of the types of Parnell's "Curved-spotted Bull-trout," p. 132, pl. 33. fig. 8.

ξ. Twenty-one inches and three-quarters: skin, female. Firth of Forth. Type of Parnell's "Crescent-tailed Bull-trout," p. 133, pl. 34. fig. 9.—Cæc. pyl. 50.

ο. Twenty-one inches and a quarter: skin. Solway. From Mr. Parnell's Collection.

π–ρ. Twenty-one inches: skin. Firth of Forth. From Mr. Parnell's Collection.

s. Nineteen inches: skin, female. Firth of Forth. Type of Parnell's "Salmon Bull-trout," p. 133, pl. 33*.—Cæc. pyl. 54.

τ. Seventeen inches and a half: skin. River Annan. From Mr. Parnell's Collection.

υ. Four inches and three-quarters: skin. South Esk, Forfarshire. From Mr. Parnell's Collection.

φ. Four inches and a half: skin. Tweed. From Mr. Parnell's Collection.

ψ. A great number of skins of specimens of all ages. Firth of Forth and Solway. From Mr. Parnell's Collection.

Fordwich Trout.

ω. Female, very fine specimen, 19 inches long. Fordwich. Presented by the Right Hon. Earl Cowper.—Cæc. pyl. 50.

Irish Specimens.

aa. Sixteen inches: skin. Lough Neagh. From Mr. Parnell's Collection.

bb. Fourteen inches and a half: skin, female. County of Down. From Mr. Yarrell's Collection.

Osteology.

cc, dd. Skeletons of large specimens, male and female. Tweed. Presented by His Grace the Duke of Roxburgh.

Specimens supposed to be hybrids between Salmo trutta *and* Salmo gaimardi.

a. Male, 16 inches long. Lossie River, Moray Firth. Presented by Capt. J. B. Dunbar. Caught in March. Cæc. pyl. 38.

b. Female, 13 inches long. Lossie River, Moray Firth. Presented by Capt. J. B. Dunbar. Caught March 8th. Cæc. pyl. 38.

c–d. Females, 15 and 13 inches long. Lossie River, Moray Firth. Presented by Capt. J. B. Dunbar. Caught in April. Cæc. pyl. 42. The smaller specimen is sterile.

e–g. Females, from 10 to 12 inches long. Lossie River, Moray Firth. Presented by Capt. J. B. Dunbar.—Vert. 60; cæc. pyl. 36–46. These specimens were caught on the 24th of March, at which time specimens of this fish of the size indicated run up the river, but for a short time only, and without spawning.

h–i. Many specimens, from 6 to 7 inches long. Lossie River, Moray Firth. Presented by Capt. J. B. Dunbar. Caught in March and April.

All the British specimens of *Salmo trutta* which I have examined (with the exception of the Fordwich Trout) are from Scotland, and all those obtained from the rivers of Wales and southern England belong to *Salmo cambricus* (eriox). According to Parnell and Yarrell, both these species would be found in Scotland as well as in England; but a careful examination of the typical specimens described by those ichthyologists has shown me that the former applied the name of *eriox* to those specimens of *S. trutta* which had the teeth on the vomer more completely preserved, or which had more numerous spots than others. But it is well known that no distinction of species can be based upon such trivial grounds. However, a few of the specimens named *S. trutta* by Parnell deviate so much from the typical form, in having a stouter body or shorter fins or a more perfect dentition on the vomer, that they might be taken for a distinct species. But as they do not agree one with another

in several characters, it appears to me to be much more probable that they are hybrids between the Sea-Trout and the common River-Trout.

Yarrell's collection of these fishes was chiefly composed of English and Welsh specimens, and he promiscuously named a part *S. trutta* and another *S. eriox*, generally applying the former name to females (with a shorter head), and the latter to males (which have the head more elongate). However, he was perfectly right in directing attention to the difference in the shape of the gill-cover, which is very characteristic for the two species, at least in most of the individuals. But he was not aware that numerous variations occur, and that there are specimens of *S. trutta* and *S. eriox* (*cambricus*) which have the gill-covers of precisely the same shape.

In these cases only an examination of the internal parts of the maxillary and mandible can decide to what species such individuals ought to be referred, these bones being much stronger and more solid in *S. cambricus* than in *S. trutta*. It is probable that the figure of *S. trutta* given by Yarrell on the first page of the description is taken from a Scotch example which he procured in the "London market" for his collection.

Nilsson's description agrees very well with the British *Salmo trutta*, except in one point, viz. in the length of the maxillary bone, which, according to him, extends to behind the eye. This is the case in very old males only.

Description of a Male Sea-Trout from the Tweed, caught in the month of November, apparently engaged in spawning.

	inches.
Total length	35
Greatest depth of the body	7⅔
Length of the head	8
Least depth of the tail	3
Distance between end of snout and eye	3½
Diameter of the eye	⅞
Length of the maxillary bone	3⅞
Greatest width of operculum	1¼
Greatest depth of operculum	2½
Distance between occiput and dorsal fin	11
Distance between end of dorsal and root of caudal	12
Length of base of dorsal	3
Length of pectoral	4¼
Distance between root of pectoral and root of ventral	9½
Length of ventral fin	3¼
Distance between root of ventral and origin of anal	7
Length of anal	2¾
Length of longest caudal ray	4
Length of middle caudal ray	2½

The great development of the jaw-bones, and of the hook of the

lower jaw especially, the thickened skin on the back, and the state of the sexual organs show that the specimen was engaged in, or very close to the time of, spawning. The snout is so much produced that the posterior margin of the eye occupies the middle of the length of the head, the upper profile of the head is somewhat concave, the lower jaw terminates in a hook half an inch high and received into a deep hole in the upper jaw. The maxillary is comparatively not very strong, not much extending behind the hinder margin of the orbit. Two teeth are still on the front of the vomer. Adipose fin long, broad, and extremely thick. Caudal fin truncated. Scales on the back entirely covered by the skin. There are thirteen scales in a series obliquely descending from behind the adipose fin to the lateral line.

Silvery, with a light brownish-red tint all over the body. Sides with irregular black spots, each of the size of a scale.

Pyloric appendages forty-three.

Description of a Male Bull-Trout from the Tweed, caught in the month of January, during the spawning-time.

	inches.
Total length	20
Greatest depth of the body	4 1/5
Length of the head	4 2/5
Girth of the biggest part of the body	9 2/4
Least depth of the tail	1 1/2
Distance between end of snout and eye	1 3/4
Diameter of the eye	1/4
Length of the maxillary bone	1 3/4
Distance between eye and angle of præoperculum	1 2/4
Greatest width of operculum	2/4
Greatest depth of operculum	1 3/5
Distance between occiput and origin of dorsal fin	6 3/5
Distance between end of dorsal and root of caudal	7 1/5
Length of base of dorsal	1 7/8
Greatest height of dorsal	1 1/2
Length of pectoral	2 1/4
Distance between root of pectoral and root of ventral	5
Length of ventral fin	1 3/4
Distance between root of ventral and origin of anal	3 5/8
Length of anal	1 5/8
Greatest depth of anal	1 1/2
Length of longest caudal ray	2 1/4
Length of middle caudal ray	1 3/5

The greatest depth of the body is below the origin of the dorsal fin, and is two-ninths of the total length (without caudal), being a quarter of an inch shorter than the length of the head. The snout is produced, pointed, and more than half the length of the postorbital portion of the head, or four-fifths of that of the maxillary bone. The

mandible has a slight hook, but the jaws can be brought into perfect contact; the maxillary bone is longer than the snout by one-half the diameter of the eye: it is rather broad, two-thirds of the width of the orbit, and extends considerably beyond the vertical from the posterior margin of the orbit. The intermaxillary and mandibular teeth are larger than those of the maxillary and palatine bones. The body of the vomer has lost all its teeth; and only three remain, forming the transverse series across the posterior part of the head of this bone.

The distance of the nostrils from the orbit is equal to two-thirds of the diameter of the latter.

The interorbital space is very convex, the eye being situated below the upper profile of the head; the width of this space is equal to the length of the snout. Operculum and suboperculum are very thin, and concentrically striated, the striæ running parallel to the outer margin.

The posterior margin of the præoperculum is subvertical, slightly rounded, the lower limb being distinctly horizontal; the posterior margin of the operculum is almost straight, oblique, forming a right angle with the inferior limb; the suboperculum is less than thrice as long as broad. The distance from the angle of the operculum to the lower anterior end of the suboperculum is three-quarters of that from the upper end of the gill-opening to the first-named point.

The distance of the occiput from the origin of the dorsal fin, if measured back from behind that fin, reaches almost two-thirds of the space between the adipose and the root of the caudal fin. The dorsal fin is as long as high, and consists of thirteen rays, the first three being rudimentary and covered by the skin, the fourth and fifth simple, the latter being as long as the following one, which is branched and the longest in the fin; the final ray is cleft throughout.

The anal fin is higher than long, and possesses eleven rays, of which the first and second are rudimentary and covered by the skin, the third simple, the fourth branched and the longest, and the last ray cleft to its root.

Pectoral nearly as long as the postorbital portion of the head, reaching nearly two-fifths of the distance of its root from that of the ventral: ventral shorter, very slightly exceeding one-half of the distance of its root from the vent; its outermost ray is vertically opposite the ninth of the dorsal. Posterior margin of the caudal fin scarcely emarginate.

There are 117 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to that line has twenty-six scales; that forwards from the hinder end of the adipose has fifteen scales. There are twenty-two longitudinal series between the lateral line and the root of the ventral. The scales are very thin, without a trace of keel, and with the hinder margin rounded.

Bright silvery, greenish on the back, and with a slight purple shade on the side; the upper half of the body is densely covered with irre-

gularly X-shaped black spots. Sides of the head and dorsal fin with a few small round black spots. Caudal and inner side of pectoral and ventral blackish.

Pyloric appendages forty-five.

Description of a Female Sea-Trout, from the Tweed, obtained during the spawning-time, in January.

	inches.
Total length	27¾
Greatest depth of the body	5¾
Length of the head	5½
Girth of the biggest part of the body	14
Least depth of the tail	2⅛
Girth of the narrowest part of the tail	5½
Distance between the end of the snout and the eye	1¾
Diameter of the eye	⅝
Length of the maxillary bone	2 1/16
Distance between eye and angle of præoperculum	2⅛
Greatest width of operculum	1⅛
Greatest depth of operculum	2
Distance between occiput and origin of dorsal fin	8¾
Distance between end of dorsal and root of caudal	9⅝
Length of base of dorsal	2⅞
Greatest height of dorsal	2¼
Length of pectoral	2⅞
Distance between root of pectoral and root of ventral	8⅛
Length of ventral fin	2⅝
Distance between root of ventral and origin of anal	5¼
Length of anal	2¼
Greatest depth of anal	2½
Length of longest caudal ray	3
Length of middle caudal ray	1¾

The greatest depth of the body is below the origin of the dorsal fin, and slightly exceeds the length of the head, being two-ninths of the total length (without caudal).

The snout is moderately produced, conical, and is three-fifths of the length of the postorbital portion of the head, or seven-eighths of that of the maxillary bone. The mandible is without hook, and the jaws can be brought into perfect contact. The maxillary bone is longer than the snout by two-fifths of the diameter of the eye, and extends beyond the posterior margin of the orbit: the width of its broadest part is two-thirds of the diameter of the eye.

The teeth of the mandible are larger than those in the upper jaw; those of the intermaxillary bone are about equal to those of the palatine series, and are larger than those of the maxillaries. Of the vomerine teeth only two remain; they are placed in a transverse series between the head and body of the bone.

The interorbital space is very convex, the eye being situated con-

siderably below the upper profile of the head; the width of this space is one-eighth of an inch shorter than the maxillary bone, and about three-fifths of the postorbital portion of the head.

The posterior margin of the præoperculum is slightly rounded and subvertical; the lower limb is distinct. The hinder margin of the operculum is slightly rounded, and meets the lower limb at a right angle. The distance from the upper end of the gill-opening to the angle of the operculum is equal to that from the latter point to the lower anterior angle of the suboperculum.

The distance of the occiput from the origin of the dorsal fin, if measured back from behind that fin, reaches more than two-thirds of the distance between the adipose and the root of the caudal. The dorsal fin is longer than high, and possesses thirteen rays, of which the first and second are rudimentary and covered by the skin, the third simple and shorter than the following one, which is the first branched ray and the longest of the fin: the last ray is cleft throughout.

The anal fin is higher than long, and consists of twelve rays, the first and second being rudimentary and covered by the skin, the third simple and shorter than the fourth, which is branched and attains the utmost height of the fin.

Pectoral shorter than the postorbital portion of the head by one-fourth of an inch or half the diameter of the eye: ventral very slightly shorter, its length being about three-sevenths of the distance of its root from the vent; its outermost ray is vertically opposite the ninth of the dorsal.

Posterior margin of the caudal fin slightly rounded.

There are 117 transverse series of scales, counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal to the lateral line contains thirty scales; that from the hinder end of the adipose to the lateral line has fifteen scales.

Upper parts blackish; sides silvery, with a purple shade; belly white; numerous small irregular black spots on the upper half of the body. Opercles and dorsal fin with small round black spots. Caudal and adipose fin and the inner side of the pectoral and ventral blackish.

Pyloric appendages forty-six.

Description of a Male Sea-trout from the Tweed, caught in the month of January, during the spawning-time.

	inches.
Total length	18½
Greatest depth of the body	3½
Length of the head	4
Girth of the biggest part of the body	8⅞
Least depth of the tail	1½
Distance between end of snout and eye	1¼
Diameter of the eye	½

	inches.
Length of the maxillary bone	$1\frac{5}{8}$
Distance between eye and angle of præoperculum	$1\frac{1}{4}$
Greatest width of operculum	$\frac{7}{8}$
Greatest depth of operculum	$1\frac{7}{16}$
Distance between occiput and origin of dorsal fin	$5\frac{1}{8}$
Distance between end of dorsal and root of caudal	$6\frac{1}{8}$
Length of base of dorsal	$1\frac{1}{8}$
Greatest height of dorsal	$1\frac{3}{4}$
Length of pectoral	$2\frac{1}{8}$
Distance between root of pectoral and root of ventral	$4\frac{3}{4}$
Length of ventral fin	$1\frac{5}{8}$
Distance between root of ventral and origin of anal	$3\frac{1}{16}$
Length of anal	$1\frac{1}{2}$
Greatest depth of anal	$1\frac{3}{4}$
Length of longest caudal ray	$2\frac{3}{8}$
Length of middle caudal ray	$1\frac{3}{8}$

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and two-thirds in the total length (without caudal); the length of the head four times and a quarter. The snout is produced, pointed, and three-fifths of the length of the postorbital part of the head, or five-sixths of that of the maxillary bone; the mandible has scarcely a trace of a tubercle at its extremity, and the jaws can be brought into perfect contact. The maxillary bone is longer than the snout by half the diameter of the eye, and is not very strong, its greatest width being less than two-thirds of the diameter of the eye; and it extends considerably behind the vertical from the posterior margin of the eye. The teeth of the intermaxillary and mandibular series are stronger and larger than those of the maxillary and palatine bones. All the teeth of the vomer are lost, except three, which occupy the hinder part of the head of this bone.

The distance of the nostrils from the orbit is somewhat less than the diameter of the latter. The interorbital space is convex, the eye being situated below the upper profile of the head; the width of this space is equal to the length of the snout.

The præoperculum has the posterior margin scarcely rounded, and the lower limb horizontal: operculum and suboperculum very thin, concentrically striated, the striæ running parallel to the gill-opening; the posterior margin of the operculum is very slightly rounded, meeting the lower limb at a right angle; suboperculum of moderate width, two-fifths as broad as long. The distance from the angle of the operculum to the lower anterior end of the suboperculum is three-fourths of that from the upper end of the gill-opening to the first-named point.

The distance of the occiput from the origin of the dorsal fin, if measured back from behind that fin, reaches three-fourths of the space between the adipose and the root of the caudal fin. The dorsal fin is longer than high, and possesses thirteen rays, of which the first and second are rudimentary, the third simple and much shorter than

the following ray, which is also simple; the fifth is the first branched ray, the terminal ray cleft throughout.

The anal fin is higher than long, and consists of eleven rays, of which the two anterior ones are rudimentary, the third simple, the fourth and fifth are branched and the longest rays of the fin, whilst the final ray is cleft throughout. Pectoral as long as the postorbital portion of the head, reaching two-fifths of the distance of its root from that of the ventral: ventral shorter than the pectoral, reaching more than half the distance of its root from the vent; its outermost ray is vertically opposite the tenth of the dorsal fin.

Posterior margin of the caudal fin scarcely emarginate.

There are 117 transverse rows of scales, counted immediately above the lateral line; the series descending obliquely from the origin of the dorsal fin to the lateral line contains twenty-eight scales; that from the hinder end of the adipose forward to the lateral line has fourteen scales. There are twenty-two series between the lateral line and the root of the ventral.

Back and upper parts of the side dark purplish, with numerous irregularly X-shaped black spots; the remainder of the body silvery, each scale being surrounded by minute brown dots; sides of the head and dorsal fin with a few small, round, black spots. Caudal, inner side of pectoral and ventral, blackish.

Pyloric appendages fifty-eight.

3. Salmo cambricus.

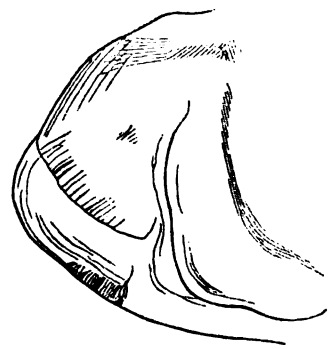
Sewin *in Wales*; Bull Trout.
Salmulus, *Willughby*, p. 192 (young).
?? The Grey, *Willughby*, p. 193; *Penn. Brit. Zool.* iii. p. 258.
?? Salmo No. 2, *Artedi, Genera*, p. 12; *Synon.* p. 23; *L. Faun. Suec.* p. 116. no. 307. (Artedi composes this species of "The Grey" of Willughby, and of the Swedish "Grälax;" he has not examined either of them, nor does he give a description.)
?? Salmo eriox, *L. Syst. Nat.* i. p. 509, is the Swedish "Grälax."
Salmo eriox, part., *Yarrell, Brit. Fish.* 2nd edit. ii. p. 71; 3rd edit. i. p. 234.
Salmo cambricus, *Donov. Brit. Fish.* iv. pl. 91 (moderate figure of a specimen in the Grilse state); *Richards, Faun. Bor.-Amer. Fish.* p. 141, pl. 91. fig. 2 (head).
Sewen, *Couch, Fish. Brit. Isl.* iv. p. 208, pl. 213.
Blue Poll (S. albus), *Couch, l. c.* p. 219, pl. 216.

Peal, Salmon-Peal. Specimens sent to us under this name are identical with the Sewin. The account of the habits of this supposed species, given by Couch (*l. c.* p. 200), is compiled from his own observations and from those of other authors; but there is no evidence to show that they refer to one and the same fish. The figure by which this account is illustrated (pl. 212), shows the dorsal fin more advanced towards the head than we have ever seen in a British Salmonoid.

B. 10–11. D. 14. A. 11–12. P. 16. V. 9. L. lat. 120–125. L. transv. $\frac{27}{38-40}$. Vert. 59. Cæc. pylor. 39–47, rarely more.

Attaining to a length of about 3 feet; female mature at a length of from 12 to 13 inches.

Head rather long, compared with its depth; operculum rather short, its length being contained in its depth once and four-fifths in large (32-in.) specimens, once and three-fifths in adult ones (22-in.), once and two-fifths in specimens in the Grilse-state, and once and one-fifth in specimens in the Parr-state; like the other bones of the skull, it is well ossified, and striæ radiating from the base towards the hinder edge are much more conspicuous than concentric marginal striæ. The hind margin of the gill-cover is more or less produced, the suboperculum projecting beyond the end of the opercle. The posterior point of junction of operculum and suboperculum is much nearer to the lower end of the suboperculum than to the upper end of the gill-opening; and only in very young examples are the distances between these points equal. Præoperculum with a distinct lower limb, with the angle rounded, and with the hind margin convex or undulated, subvertical. Snout rather long, much produced in males, in which the lower jaw becomes hooked during the spawning-season. Maxillary strong, solid, longer than the snout; in specimens of the Grilse-state (about 12 in. long) it already extends to the vertical from the hind margin of the orbit, or even beyond it; and in larger ones, females as well as males, it constantly exceeds that line; in examples 6 inches long it reaches beyond the middle of the orbit. Head of the vomer triangular, broader than long, toothless in adult examples, and armed with a few teeth across its hinder margin in young ones; body of the bone with a sharp longitudinal ridge, in the sides of which the teeth are inserted, forming a single series, and alternately pointing towards the right and left; in pure (non-hybrid) specimens these teeth are lost in the Grilse-state, so that only the two or three anterior remain in specimens more than 12 or 13 inches long.



Fins of moderate length: the caudal fin is forked in specimens 6 inches long, in which the longest rays are not twice as long as the middle ones; it shows only a slight emargination in specimens in the Grilse-state, and is perfectly truncate in adult examples, but never rounded. Tail not elongate, covered with thin, short, rounded scales, like the body; there are fourteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line. Scales of young examples very deciduous.

This species loses the Parr-marks as soon as it is from 5 to 6 inches

long; it is then bright-silvery, greenish on the back, with a few small, round, black spots on the head and sides. This coloration remains nearly unaltered during the further growth of the fish, but the spots are more irregular, indistinctly X-shaped, sometimes two or three confluent.

A migratory species, occurring in rivers of Norway, Denmark, England, Wales and Ireland.

a, b, c. Male and females, from 22–27 inches long. River Rhymney, Monmouthshire. Presented by the Rev. Augustus Morgan*.

d. Female, 20 inches long, belonging to the big-headed variety. Rhymney. Presented by the Rev. Augustus Morgan.

e. Female, 15 inches long. Rhymney. Presented by the Rev. Augustus Morgan. This specimen was kept for some time in a freshwater pond, and has the body much emaciated, and the fin-rays have grown to an unusual length.

f, g, h, i–o. Males and females, from 12–15 inches long. Rhymney. Presented by the Rev. Augustus Morgan.

p. Female, 14 inches long. Towey, near Taliaris. Presented by W. Peel, Esq. Caught in April.

q, r. Male and female, from 12 to 13 inches long. Rhymney. Presented by the Rev. Augustus Morgan. Caught in April, both specimens having spawned.

s. Female, 11 inches long. Rhymney. Presented by the Rev. Augustus Morgan. This specimen belongs to the small-headed variety, and has thirteen anal rays.

t–x. Males and females, from 10 to 13 inches long. Rhymney. Presented by the Rev. Augustus Morgan.

y–γ. Six inches long. Rhymney. Presented by the Rev. Augustus Morgan.

δ, ε, η. Numerous specimens in smolt-dress, from 6 to 7 inches long. Rhymney. Presented by the Rev. Augustus Morgan. Caught on April 20, before the time for running down to the sea.

ζ. Seven inches and a half long. Taliaris (South Wales). Presented by W. Peel, Esq. This specimen had been kept in a freshwater pond for more than a year.

θ. Several young examples. River Usk. Presented by J. Lloyd, Esq., jun.

ι. Twenty inches long: skin. Pembroke. From Mr. Yarrell's Collection.

κ. Male, 13 inches long: skin. Wales. From Mr. Yarrell's Collection. This specimen lived for twelve months in a freshwater pond.

λ. Ten inches long. Wales. Presented by — Stokes, Esq.

μ. Seven inches and a half long. River Torridge. Presented by Dr. A. Günther.

ν. Female, 19 inches long: skin. River Allan, Cornwall. From Mr. Yarrell's Collection. Weight 3¼ lbs. Cæc. pyl. 45.

* Cæc. pyl. 39 twice, 40 and 41 once, 44 twice, 47 and 54 once, in examples from the Rhymney.

ξ. Female, 13 inches long: skin. River Allan. From Mr. Yarrell's Collection. Cæc. pyl. 47.

o. Female, 12½ inches long: skin. Looe Pool, near Helston, Cornwall. From Mr. Yarrell's Collection.

π, *ρ*. Males, 24 inches long: skins. River Tamar, South Devon. From Mr. Yarrell's Collection. Cæc. pyl. 35.

σ, *τ*, *υ*. Male and females, 18 inches long: skins. River Tamar. From Mr. Yarrell's Collection. Cæc. pyl. 43.

φ. Male, 13 inches long: skin. River Tamar. From Mr. Yarrell's Collection. Cæc. pyl. 47.

ψ. Several skins of specimens from 7 to 15 inches long. River Tamar. From Mr. Yarrell's Collection.

ω. Several half-grown and young specimens. River Tavy, near Plymouth: skins. From Mr. Yarrell's Collection.

aa. Many young specimens, from 5 to 8 inches long: skins. River Plym. From Mr. Yarrell's Collection.

bb. Female, 14 inches long: skin. Plymouth Sound. From Mr. Yarrell's Collection. Cæc. pyl. 38.

cc. Female, 13 inches long: skin. Caught in a net in Cawsand Bay, near Plymouth. From Mr. Yarrell's Collection.

dd. Skins of several examples from 11 to 22 inches long. River Erme, South Devon. From Mr. Yarrell's Collection. Cæc. pyl. 33, 37, 38, 41, 42, 43, 43, 48, 52.

ee. Male, 14 inches long. River Avon. Presented by Mr. Tegetmeier. Caught in September. Cæc. pyl. 39.

ff. Skins of several examples from 9 to 20 inches long. River Avon. From Mr. Yarrell's Collection. Cæc. pyl. 41–42.

gg. Female, 18 inches long: skin. River Yealm, South Devon. From Mr. Yarrell's Collection. Cæc. pyl. 34.

hh. Six inches and a half long: stuffed. River Yealm. Presented by Lieut. H. F. Spence, R.N.

ii. Male, 18 inches long: skin. River Dart, South Devon. Presented by Lieut. H. F. Spence, R.N.

kk, *ll*. Male and Female, 13 inches long: skins. River Dart. From Mr. Yarrell's Collection. Local name, "Salmon-Peal."

mm, *nn*. Males, 32 and 25 inches long: skins. England. From Mr. Yarrell's Collection.

oo. Female, 15 inches long: skin. This specimen was purchased by Yarrell in the London market, and is the type of the figure given in page 72 of the second volume of the second edition of the 'British Fishes;' it is one of those specimens in which the distinctive characters of the species are very little developed; and it is quite possible that the specimen came from Scotland, and belongs to *Salmo trutta*.

Irish specimens.

pp–ss. Males, from 15 to 29 inches long: skin. Lough Neagh. From Mr. Yarrell's Collection. Cæc. pyl. 46.

Continental specimens.

tt, uu. Females, 20 and 13 inches long. Denmark. Presented by the Copenhagen Museum. Caught in November; ova mature. Cæc. pyl. 42 and 49.

vv, ww. Males, 17 and 14 inches long. Jütland. Presented by the Copenhagen Museum. Caught in November; sexual organs not developed. Cæc. pyl. 49. These specimens had freely fed on marine Amphipodes and sea-fishes (*Ammodytes*), and therefore must have been caught in the sea.

xx, yy. Females, 8 and 10 inches long. Jütland. Presented by the Copenhagen Museum. Caught in November; sexual organs not developed.

zz. Fine female specimen, 30 inches long. Sogne Fjord, Norway. Presented by Prof. N. S. Maskelyne.

Osteology.

aa. Adult male; skeleton. Rhymney. Presented by the Rev. Augustus Morgan.

Description of an Adult Male specimen from the Rhymney, taken during the spawning-time.

	inches.
Total length	24
Greatest depth of the body	4 1/4
Length of the head	5 1/8
Girth of the biggest part of the body	10
Least depth of the tail	1 7/8
Girth of the narrowest part of the tail	4 1/2
Distance between the end of the snout and the eye	1 3/4
Length of the maxillary bone	2
Distance between eye and angle of præoperculum	1 3/4
Greatest width of operculum	1 5/8
Greatest depth of ditto	1 5/8
Distance between occiput and origin of dorsal fin	6 1/8
Distance between end of dorsal and root of caudal	8 1/2
Length of base of dorsal	2 1/2
Greatest height of dorsal	2 3/8
Length of pectoral	2 7/8
Distance between root of pectoral and root of ventral	5 1/4
Length of ventral fin	2 3/8
Distance between root of ventral and origin of anal	4 1/2
Length of anal	1 7/8
Greatest depth of anal	2 5/8
Length of longest caudal ray	3
Length of middle caudal ray	1 3/4

The greatest depth of the body is below the origin of the dorsal fin, and is contained five times in the total length (without caudal); the length of the head is contained four times and a half in the same.

The snout is produced, pointed, and is contained once and one half in the postorbital portion of the head; the mandible has a small hook, about one line in height, but the jaws can be almost perfectly closed; the maxillary bone is longer than the snout by about half the diameter of the eye, and extends beyond the posterior margin of the orbit; the width of its broadest part is less than the diameter of the eye.

The dentition of the jaws and palate is perfect, the mandibular, intermaxillary and palatine teeth being equal and larger than those of the maxillary. Of the vomerine teeth only three remain, which are situated behind the head of the vomer. The head of the vomer is triangular, broader than long, and the body of the bone has a slight transverse ridge where it joins the head.

The distance of the nostrils from the orbit is about two-thirds of the diameter of the latter; the interorbital space is very convex, but somewhat flattened above, the orbit situated far below the upper profile of the head; the width of the interorbital space is three-eighths of an inch shorter than the maxillary bone, and one quarter of an inch shorter than the distance between the pupil and the angle of the præoperculum.

The præoperculum has the posterior margin subvertical, slightly undulated, the angle and lower margin rounded, the latter being perfectly distinct. The greater part of the posterior margin of the operculum is straight, and placed at a right angle to its lower margin, the angle of the suboperculum being much rounded. A line taken from the upper end of the gill-opening to the posterior angle of the operculum is one-half longer than one from that point to the lower anterior angle of the suboperculum. Suboperculum very narrow, more than thrice as long as deep.

The distance of the origin of the dorsal fin from the occiput, if carried backwards from behind that fin, reaches a little beyond the adipose. The dorsal fin is a little longer than high, and composed of fourteen rays, the three anterior ones being rudimentary and enveloped in skin, whilst the fourth is simple, much shorter than the fifth and sixth, which are branched and the longest of the fin. The last ray is cleft to the base.

The length of the anal fin is two-thirds of its height, and the fin is composed of eleven rays, of which the first and second are rudimentary and enveloped in the skin, the third simple, shorter than the fourth and fifth, which are branched, equal, and the longest of the fin. The last ray is cleft to the base.

Pectoral fin longer than the postorbital portion of the head by one-half the diameter of the eye: ventral fin shorter, its length being equal to somewhat more than half the distance of its root from the vent; its outer ray is in the vertical from the tenth of the dorsal. Posterior margin of the caudal fin truncated.

There are 117 transverse series of scales, counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal to the lateral line contains twenty-seven or twenty-eight scales, and there are twenty longi-

tudinal series of scales between the lateral line and the base of the ventral. The transverse series descending forwards from behind the adipose fin to the lateral line is composed of sixteen scales. All the scales are obtusely rounded behind.

Back greenish-brown; sides silvery; belly dark brown; scattered black, X-shaped spots, irregularly distributed, and sometimes confluent so as to form an irregular small blotch, occupying the sides above and below the lateral line. Fins immaculate, with a blackish tinge.

Description of an Adult Female specimen from the Rhymney, taken with the male fish described.

	inches.
Total length	22¼
Greatest depth of the body	4½
Length of the head	4¾
Girth of the biggest part of the body	10½
Least depth of the tail	1¾
Girth of the narrowest part of the tail	4½
Distance between the end of the snout and the eye	1⅝
Length of the maxillary bone	1⅛
Distance between the eye and the angle of the præoperculum	1⅞
Greatest width of the operculum	1
Greatest depth of the operculum	1⅝
Distance between occiput and origin of dorsal fin	6⅝
Distance between end of dorsal and root of caudal fin	7¾
Length of base of dorsal	2¼
Greatest height of dorsal	2
Length of pectoral	2¾
Distance between root of pectoral and root of ventral	5¾
Length of ventral fin	2⅜
Distance between root of ventral and origin of anal	4½
Length of anal	1⅞
Greatest depth of anal	2¼
Length of the longest caudal ray	3½
Length of the middle caudal ray	1¾

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and two-thirds in the total length (the caudal not included); the length of the head is a little less than one-fourth of the same. The snout is moderately produced, conical, and is contained once and three-quarters in the postorbital portion of the head; the lower jaw is without a hook, and the mouth closes perfectly; the maxillary is considerably longer than the snout, and extends far beyond the vertical from the posterior margin of the orbit; the width of its broadest part is less than the diameter of the eye. The dentition of the jaws and palate is perfect, the teeth of the mandible being rather stronger than those of the intermaxillary and much longer than those of the maxillary and palatine bones; of the

vomerine teeth only three remain. The head of the vomer is subtriangular, rather broader than long; the body of this bone has a slight transverse ridge where it joins the head, and is provided with a sharp, prominent longitudinal ridge bearing the teeth. One of the three teeth occupies the transverse ridge, the two others the front part of the longitudinal one. The distance of the nostrils from the orbit is about two-thirds of the diameter of the latter; the interorbital space is very convex, the orbit being far below the upper profile of the head; the width of the interorbital space is about four-fifths the length of the maxillary bone, and two-thirds that of the space between the pupil and the angle of the præoperculum. The posterior margin of the operculum is straight, but inclining backwards considerably as it descends; it is placed at right angles to its lower margin, the angle of the suboperculum being much rounded; a line drawn from the upper end of the gill-opening to the point of junction of the operculum and suboperculum is somewhat less than twice the length of one from that point to the lower end of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if carried backwards from behind that fin, reaches to almost midway between the adipose and the root of the caudal. The dorsal fin is rather longer than high, and composed of fourteen rays, the three anterior ones being rudimentary and enveloped in skin, whilst the fourth is simple but much shorter than the fifth and sixth, which are branched and the longest of the fin. The anal fin is higher than long, and composed of eleven rays, of which the first and second are rudimentary and enveloped in the skin, the third simple, while the fourth and fifth are branched, equal in length, and the longest of the fin; the last ray is split to its base. Pectoral fin nearly as long as the postorbital portion of the head: ventral fin shorter, its length being one-half the distance of its root from the vent; its outer ray is in the vertical from the middle of the dorsal fin. Posterior margin of the caudal fin truncated.

There are 125 transverse series of scales, counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-seven or twenty-eight scales, and there are twenty longitudinal series of scales between the lateral line and the base of the ventral. The transverse series descending forward from behind the adipose fin to the lateral line is composed of fourteen scales; all the scales are obtusely rounded behind.

Back greenish; sides and belly silvery; scattered black spots, rather irregular in shape, and about twice as large as a scale, occupy the sides above and below the lateral line. Operculum and basal portion of the dorsal fin with small, round, black spots. The other fins immaculate, with a blackish tinge.

Description of a Male specimen in the Grilse-state (after first return from the sea), from the Rhymney.

	inches.
Total length	14
Greatest depth of the body	$2\frac{5}{8}$
Length of the head	$2\frac{7}{8}$
Girth of the biggest part of the body	6
Least depth of the tail	$1\frac{1}{8}$
Girth of narrowest part of the tail	$2\frac{1}{8}$
Distance between end of snout and eye	$\frac{3}{8}$
Length of maxillary bone	$1\frac{1}{8}$
Distance between eye and angle of præoperculum	$1\frac{1}{16}$
Greatest width of operculum	$\frac{5}{8}$
Greatest depth of operculum	1
Distance between occiput and origin of dorsal	$3\frac{7}{8}$
Distance between end of dorsal and root of caudal	$4\frac{6}{8}$
Length of base of dorsal	$1\frac{3}{8}$
Greatest height of dorsal	$1\frac{1}{2}$
Length of pectoral	$1\frac{6}{8}$
Distance between root of pectoral and root of ventral	$3\frac{5}{16}$
Length of ventral fin	$1\frac{3}{8}$
Distance between root of ventral and origin of anal fin	$2\frac{2}{8}$
Length of anal fin	$\frac{7}{8}$
Greatest depth of anal	$1\frac{1}{2}$
Length of longest caudal ray	2
Length of middle caudal ray	$\frac{7}{8}$

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and three-fourths in the total length (without caudal); the length of the head is contained four times and one-third in the same. The snout is scarcely produced, conical, and is one-half the length of the postorbital portion of the head; the mandible is without hook, and the jaws close perfectly; the maxillary bone is longer than the snout by about one-half the diameter of the eye, and extends slightly beyond the posterior margin of the orbit, the width of its broadest part being less than the diameter of the eye. The mandibulary, intermaxillary, and palatine teeth are about equal in size and larger than those of the maxillary. Of the vomerine teeth very few remain even at this early age; three of them are situated behind the head of the vomer, and one in the middle of the length of the longitudinal ridge.

The distance of the nostrils from the orbit is about two-thirds of the diameter of the latter; the interorbital space is convex and somewhat flattened above, the orbit being situated somewhat below the upper profile of the head, the width of the interorbital space is one-eighth of an inch shorter than the length of the maxillary bone, and one-fourth of an inch shorter than the distance between the pupil and the angle of the præoperculum. The præoperculum has the hinder margin rounded, as also the angle and lower limb, which is less perfectly distinct than in the full-grown fish. The posterior margin of

the operculum is very slightly rounded, and placed at a right angle to its lower margin; the angle of the subopercular is also rounded. A line taken from the upper end of the gill-opening to the angle of the operculum is one-eighth of an inch longer than one from that point to the lower anterior angle of the subopercular.

The distance of the origin of the dorsal fin from the occiput, if carried back from behind that fin, reaches to a little less than half-way between the adipose and the root of the caudal. The dorsal fin is a little shorter than high, and composed of fourteen rays, the three anterior ones being rudimentary and enveloped in the skin, whilst the fourth is simple, shorter than the fifth and sixth, which are branched and the longest of the fin; the last ray is cleft to the base.

The length of the base of the anal fin is about two-thirds of its height, and the fin is composed of eleven rays, of which the first and second are rudimentary and enveloped in skin, the third simple and much shorter than the fourth, which is also simple; the fifth is the first branched ray and the longest of the fin; the last ray is cleft to the base. The pectoral fin slightly exceeds in length the postorbital portion of the head: ventral fin shorter, its length being rather more than one-half of the distance of its root from the vent; its outer ray is in the vertical from the tenth of the dorsal. Posterior margin of the caudal fin emarginate.

There are 130 transverse series of scales, counted immediately above the lateral line on one side of the body, and 121 on the other; but it is to be noticed that the series are not quite as regular as is usually the case; the transverse series descending obliquely backwards from the origin of the dorsal to the lateral line contains twenty-five scales, and there are twenty longitudinal series of scales between the lateral line and the base of the ventral. The transverse series descending from behind the adipose fin to the lateral line is composed of fifteen scales. All the scales are rounded behind, but less obtusely than in larger specimens.

Back greenish; sides and belly silvery; scattered black X-shaped spots on the sides above the lateral line, and sparingly on the anterior part of the body below that line. Dorsal fin with two or three series of black spots; other fins immaculate, with a blackish tinge. Operculum with a single rounded black spot.

Description of a Female specimen in the Grilse-state, with thirteen anal rays; caught in the Rhymney in the month of August.

	inches.
Total length	11½
Greatest depth of the body	2¼
Length of the head	2 3/16
Girth of biggest part of the body	5½
Least depth of the tail	1
Girth of narrowest part of the tail	2½
Distance between end of snout and eye	9/16
Length of maxillary bone	7/8

	inches.
Distance between eye and angle of præoperculum ..	$\frac{3}{4}$
Greatest width of operculum	$\frac{7}{16}$
Greatest depth of operculum	$\frac{3}{4}$
Distance between occiput and origin of dorsal fin ..	3
Distance between end of dorsal and root of caudal ..	4
Length of base of dorsal	$1\frac{1}{8}$
Greatest height of dorsal	$1\frac{3}{16}$
Length of pectoral	$1\frac{1}{2}$
Distance between root of pectoral and root of ventral	$2\frac{3}{4}$
Length of ventral fin	$1\frac{1}{2}$
Distance between root of ventral and origin of anal..	$1\frac{7}{8}$
Length of anal fin	1
Greatest depth of anal	$1\frac{5}{16}$
Length of longest caudal ray	$1\frac{1}{2}$
Length of middle caudal ray	$\frac{3}{4}$

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and a half in the total length (without caudal); the length of the head bears about the same proportion. The snout is moderately produced, conical, and contained twice in the postorbital length of the head; the lower jaw is without hook, the mouth closing perfectly; the maxillary bone is longer than the snout by about three-fourths the diameter of the eye, and does not reach quite to the vertical from the hinder margin of the orbit; the width of its broadest part is about half the diameter of the eye.

The dentition of the jaws and palate is perfect, the mandibulary teeth being slightly larger than those of the intermaxillary and palatines, which are equal and, again, slightly exceed the maxillary teeth. The body of the vomer is armed with six teeth, which form a single series, and are rather remote from one another, the last being not far from the hinder extremity of the bone. The interorbital space is convex, the orbit being slightly below the upper profile of the head: the width of this space is one-eighth of an inch shorter than the maxillary bone. The præoperculum has the hinder margin, angle, and lower limb rounded, the latter being very distinct; the posterior margin of the operculum is very slightly rounded, and placed nearly at right angles to its lower limb; the angle of the suboperculum is rounded. A line taken from the upper end of the gill-opening to the angle of the operculum is equal to the length of another line from the latter point to the lower end of the suboperculum.

The distance of the origin of the dorsal fin from the occiput exceeds by one quarter of an inch the distance of its posterior end from that of the adipose, and equals somewhat more than two-thirds of its distance from the root of the caudal fin. The dorsal fin is nearly as long as high, and composed of fourteen rays, of which the first two are rudimentary and enveloped in the skin, the third simple and about half as long as the fourth, which is also simple; the fourth, fifth, and sixth rays are nearly equal in height, the fifth being the first branched ray. The last ray is cleft to the base.

The anal fin is one-third higher than long, and consists of thirteen rays, the first two being rudimentary and covered by the skin; the third slightly shorter than the fourth and fifth, which are branched rays and the longest of the fin; the last ray is cleft to the base. Pectoral longer than the postorbital length of the head by one-fourth of that length: ventral shorter, its length being a little less than two-thirds of the distance of its root from the vent; its outer ray is in the vertical from the eleventh of the dorsal. Posterior margin of the caudal distinctly emarginate.

There are 120 transverse series of scales counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-eight scales, and there are twenty-two longitudinal series between the lateral line and the root of the ventral. The transverse series descending forwards from behind the adipose fin contains fourteen scales. All the scales are rounded behind.

Back brownish green, passing into silvery on the sides; scattered black spots of an irregular X-shape along the sides above the lateral line, and a few similar ones on the anterior part of the body below that line; the operculum has one very distinct black spot in the centre. Dorsal fin with three series of black spots; the other fins immaculate, and with a very slight greyish tinge.

Description of a young Male, in the Smolt-state (before going down to the sea), from the Rhymney.

	inches.
Total length	6 7/8
Greatest depth of the body	1 3/8
Length of the head	1 7/16
Girth of the biggest part of the body	3 1/4
Least depth of the tail	9/16
Girth of narrowest part of the tail	1 1/8
Distance between end of snout and eye	2/5
Length of maxillary bone	9/16
Distance between eye and angle of præoperculum	1/2
Greatest width of operculum	2/5
Greatest depth of operculum	1/2
Distance between occiput and origin of dorsal fin	1 1/4
Distance between end of dorsal and root of caudal	2 5/16
Length of base of dorsal	2/5
Greatest height of dorsal	1 3/16
Length of pectoral	1
Distance between root of pectoral and root of ventral	1 7/8
Length of ventral fin	3/4
Distance between root of ventral and origin of anal fin	1 3/16
Length of anal fin	7/16
Greatest depth of anal	3/4
Length of longest caudal ray	4/5
Length of middle caudal ray	9/16

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and a half in the total length (without caudal), the length of the head four times and a quarter in the same. The snout is obtuse, conical, and its length is contained twice and a half in the postorbital length of the head; the maxillary bone is longer than the snout by two-thirds of the diameter of the eye, and does not reach to the vertical from the hinder margin of the eye; the width of its broadest part is less than the diameter of the eye.

The dentition of the jaws and palate is perfect, the mandibulary, intermaxillary, and palatine teeth being equal and much larger than those of the maxillary. The vomer has the head triangular, slightly broader than long, and retains three teeth on its hinder margin: there is also a series of teeth running along the longitudinal ridge, these teeth being bent alternately to the right and left, but not disposed in pairs.

The distance of the nostrils from the eye is about half the diameter of the latter; the interorbital space is very slightly convex, the eye being situated close to the upper profile of the head; the width of this space is one-eighth of an inch shorter than the maxillary bone, and equal to the distance between the pupil and the angle of the præoperculum; the præoperculum has the hinder margin subvertical, and the angle and lower limb rounded, the latter being perfectly distinct; the posterior margin of the operculum is straight and oblique, and placed at a right angle to its lower margin. A line taken from the upper end of the gill-opening to the point of junction of the operculum and suboperculum is about one-sixteenth of an inch longer than a line from the latter point to the lower anterior end of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if carried back from behind that fin, reaches to midway between the adipose and the root of the caudal. The dorsal fin is a little higher than long, and composed of fourteen rays, of which the first three are rudimentary and enveloped in the skin, the fourth simple, shorter than the fifth, which is the first branched ray and the longest of the fin.

The anal fin is more than one-third higher than long, and consists of eleven rays, of which the first is rudimentary and covered by the skin, the second simple and half as long as the third, which is also simple; the fourth is the first branched ray and the longest of the fin; the last ray is cleft to the base.

Pectoral longer than the length of the postorbital part of the head by one-eighth of an inch: ventral shorter, its length being equal to almost one-half of the distance of its root from the vent; its outer ray is on the vertical from the tenth of the dorsal fin. Caudal deeply emarginate.

There are 122 transverse series of scales, counted immediately above the lateral line: the series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains about twenty-seven scales; that from the adipose fin forwards to the lateral line contains fourteen scales; and there are about twenty-four longi-

tudinal series between the lateral line and the root of the ventral. All the scales are rounded behind, extremely delicate, very deciduous, and loaded with a silvery pigment.

Coloration silvery; back with a greenish shade becoming darker on the upper part of the head; numerous distinct blackish spots of about the size of two scales are scattered on the sides above the lateral line and sparingly below it. Operculum with several black spots, no red spots whatever. Dorsal with several rows of black spots.

Caudal and pectoral blackish; ventral and anal perfectly white.

Hybrid between Sewin (S. cambricus) and River-Trout (S. fario).

Hybrids between the Sewin and Trout are of no uncommon occurrence, and in several parts of South Wales they have received a distinct name, *Twb-y-dail*, literally Fall of the Leaf, indicative of the reddish shade of colour and of the dark-brown spots of the male. Most of these specimens have retained the instinct of an annual migration to the sea, and are full of milt or spawn in the autumn; and we have never had an opportunity of observing a naturally sterile individual. But W. Peel, Esq., of Taliaris Park, has stocked, for years, with young individuals of this form a fresh-water pond which has no communication with the sea: they live for years, growing to a length of from 15 to 18 inches, but remain sterile throughout their lifetime. Males are much more numerous than females.

These fishes, when young, generally more resemble the Trout, and when adult the Sewin. They have much more similarity one to another when young than after their first return from the sea. The *young*, from 4 to 11 inches long, are distinguished by their short, trout-like appearance, having at the same time the tail considerably less deeply forked than the true Sewin of the same age. The vomerine teeth are numerous, but rather placed alternately than side by side. The colours are constantly the same, the back and the sides densely covered with small, angular, black spots, and a series of round red spots along the lateral line; none of the spots are ever ocellated. We have never observed a specimen changing from this variegated colour into the bright silvery of the young true Sewin before going down to the sea for the first time. The dorsal and anal have a bright yellow antero-superior margin, the former with numerous oval black spots; pectoral, ventral, and anal light lemon-coloured.

After their first return from the sea, these fishes are generally rather inferior in size to the Sewin, and, although scarcely differing from it in general form, they may be readily recognized by the reddish hue of the coloration, by the caudal fin being less distinctly emarginate, and by a more or less complete longitudinal series of vomerine teeth, which is sometimes double; generally, however, the teeth are strongly bent towards the sides.

After the *second return from the sea*, they have assumed the

strikingly different appearance which has procured for them a distinct vernacular name, *Twb-y-dail*. They are comparatively shorter than the Sewin, brownish red, or silvery with a reddish hue, and sparingly spotted with black; the dentition of the males is exceedingly strong, and the vomer is always armed with some of the teeth of the longitudinal series.

However, the specimens vary much, thereby indicating their hybrid origin, and we shall give descriptions of several forms observed.

These Welsh specimens are produced by the Sewin and that form of the River-Trout which is named *S. fario ausonii*.

A very valuable collection of Salmonoids which we received from the Copenhagen Museum, contained several specimens which, being intermediate between *Salmo cambricus* and *S. fario gaimardi*, and extremely similar to the hybrid from Wales just described, are evidently of a similar origin. Such hybrids may have been frequently regarded and described as *Salmo eriox*.

The number of vertebræ is 58 in Welsh, and 59 in Danish specimens, and that of the pyloric appendages 41, 44, 45 or 46.

* *Specimens from South Wales.*

a. Male, 19¾ inches long. Ogmore River, Glamorganshire. Presented by R. Franklin, Esq. The vernacular name of this form is Twb-y-dail.

b, c. Males, 23 inches long: skins. Glamorganshire. From Mr. Yarrell's Collection.

d, e–f. Male and female, 16 and 19½ inches long. Rhymney. Presented by the Rev. Aug. Morgan.

g–h. Females, 14 and 10 inches long. Taliaris. Presented by W. Peel, Esq. These specimens were kept in a freshwater pond for more than a year, and are sterile.

i. Male, 13 inches long. Rhymney. Presented by the Rev. Aug. Morgan.

k. Male, 11 inches long. Towey, South Wales. Presented by Dr. A. Günther.

l. Male, 9 inches long, bred in a pond at Mackin. Rhymney. Presented by the Rev. Aug. Morgan. Caught May 18th.

m–o. From 6 to 8 inches long. Towey. Presented by Dr. A. Günther.

p. Many specimens, from 6 to 12 inches long, a part of which are immature. River Usk. Presented by J. Lloyd, Esq. jun.

q. Several specimens, from 4 to 6 inches long. Rhymney. Presented by the Rev. Aug. Morgan.

r. Six inches and a half long. River near Goodwick, Pembrokeshire. Presented by Hugh Ch. Owen, Esq. Caught in the middle of March.

s. Seven inches long. River Cleddan, Pembrokeshire. Presented by Hugh Ch. Owen, Esq. Caught in the middle of March.

** *Specimens from Denmark.*

t–v. Two Females, 13–14 inches long, with mature ova; and one Male, 12 inches long, with the testes fully developed. Caught in November. Presented by the Copenhagen Museum. Cæc. pyl. 41; Vert. 59. These examples had been feeding freely on small fish.

Description of a Male Hybrid specimen from the Oymore, caught in the month of August, with the testicles fully developed.

	inches.
Total length	19¾
Greatest depth of the body	3⅝
Length of the head	4⅜
Girth of biggest part of body	9¼
Least depth of the tail	1¾
Girth of narrowest part of the tail	4
Distance between end of snout and eye	1 9/16
Length of maxillary bone	1¾
Distance between eye and angle of præoperculum	1½
Greatest width of operculum	⅝
Greatest depth of operculum	1¼
Distance between occiput and origin of dorsal fin	5⅝
Distance between end of dorsal and root of caudal	6¾
Length of base of dorsal	2 1/16
Greatest height of dorsal	2¼
Length of pectoral	2½
Distance between root of pectoral and root of ventral	4⅞
Length of ventral fin	2¼
Distance between root of ventral and origin of anal	3½
Length of anal fin	1⅝
Greatest depth of anal	2¼
Length of longest caudal ray	2¼
Length of middle caudal ray	1½

The greatest depth of the body is below the origin of the dorsal fin, and contained four times and three-fourths in the total length (without caudal); the length of the head is contained four times in the same. The snout is much produced, elongate-pyramidal, and its length is contained once and one-half in that of the postorbital part of the head; the lower jaw bears a hook about one-eighth of an inch in height, which prevents the mouth from being closed. The length of the maxillary bone exceeds that of the snout by one-half the diameter of the eye, and extends slightly beyond the vertical from the hinder margin of the orbit; its greatest width is a little more than half the diameter of the eye.

The dentition of the jaws and palate is perfect, and the teeth of the jaws are generally larger and fewer in number than in specimens of the true Sewin. The mandibulary and intermaxillary teeth are equal and much larger than those of the maxillary and palatine

bones. Of the vomerine teeth there remain three on the ridge of its hinder margin, and there is a series of teeth running along the longitudinal ridge, placed in pairs one behind the other, and bent outwards alternately to the right and left. The head of the vomer is triangular, and nearly as long as broad. The last tooth is situated behind the middle of the length of the bone.

The distance of the nostrils from the eye is equal to three-fourths the diameter of the latter; the interorbital space is convex, the eye being situated considerably below the upper profile of the head; the width of this space is three-eighths of an inch shorter than the maxillary bone, and one-eighth of an inch shorter than the space between the eye and the angle of the præoperculum.

The præoperculum has the lower half of its posterior margin distinctly emarginate, the lower limb rounded and rather indistinct. The operculum has its hinder margin rounded and the angle a right one. A line taken from the upper end of the gill-opening to the angle of the operculum exceeds in length another line from the latter point to the lower anterior angle of the suboperculum by somewhat less than one-third of that line.

The distance of the origin of the dorsal fin from the occiput, if carried backwards from the hinder end of that fin, reaches to nearly midway between the adipose and the root of the caudal. The dorsal fin is rather higher than long, and composed of fourteen rays, of which the first three are rudimentary and hidden in the skin, the fourth being about half as high as the fifth ray, which is simple and nearly equals the sixth in length, which is branched.

The anal fin is one half higher than long, and consists of twelve rays, the first two of which are rudimentary and hidden in skin, the third simple and as long as the fourth, which is the first branched ray. The last ray is cleft to the base.

Pectoral longer by three-eighths of an inch than the length of the postorbital part of the head. Ventral shorter than pectoral by three-eighths of an inch, its length being equal to two-thirds of the distance of its root from the vent; its outer ray is in the vertical from the eleventh of the dorsal. Posterior margin of caudal fin truncated.

There are about 123 transverse series of scales, counted immediately above the lateral line, and twenty-three longitudinal series between that line and the root of the ventral fin. The series descending obliquely backwards from the origin of the dorsal contains twenty-five scales; that from behind the adipose forward to the lateral line fifteen. All the scales are obtusely rounded behind.

Back reddish brown, lighter on the sides and becoming silvery white on the belly. Numerous black spots of a roundish or irregular shape, and covering generally four scales, are scattered over the sides of the body, rising upwards to the root of the dorsal fin, but elsewhere confined to the lateral regions: two or three such spots on the opercular bones. Fins immaculate, with a blackish tinge deepening towards the extremity.

Description of a Female Hybrid specimen from the Rhymney, captured in the month of October, with mature eggs.

	inches.
Total length	11½
Greatest depth of the body	3¾
Length of the head	4
Girth of biggest part of the body	9½
Least depth of tail	1½
Girth of narrowest part of tail	4
Distance between end of snout and eye	1⅛
Length of maxillary bone	1⅝
Distance between eye and angle of præoperculum	1⅜
Greatest width of operculum	⅞
Greatest depth of operculum	1¼
Distance between occiput and origin of dorsal fin	5¼
Distance between end of dorsal and root of caudal	7
Length of base of dorsal	2⅛
Greatest height of dorsal	1⅜
Length of pectoral	2⅛
Distance between root of pectoral and root of ventral	5⅛
Length of ventral fin	2
Distance between root of ventral and origin of anal	3⅞
Length of anal fin	1⅜
Greatest depth of anal	2¼
Length of longest caudal ray	2½
Length of middle caudal ray	1⅝

The greatest depth of the body is below the origin of the dorsal fin, and contained four times and three-fourths in the total length (without caudal), the length of the head four times and one-half in the same. The snout is moderately produced, somewhat pointed, and is nearly one-half the length of the postorbital part of the head. The length of the maxillary bone exceeds that of the snout by about two-thirds of the diameter of the eye, and its greatest width is a little more than one-half of the same.

The mandibulary and intermaxillary teeth are equal and larger than those of the maxillary and palatine bones. The head of the vomer is triangular, twice as broad as long; those of the vomerine teeth which remain are confined to the longitudinal ridge, where they are placed in pairs one behind the other, one of each pair being bent to the right, the other to the left. There are four of these pairs, the last being not far distant from the posterior extremity of the bone.

The interorbital space is convex, the orbit being below the upper profile of the head; the width of this space is not much less than the distance between the eye and the angle of the præoperculum, and one-fourth of an inch shorter than the maxillary bone. The præoperculum has the hinder limb, angle, and lower margin rounded, the inferior limb being distinct. The hinder margin of the operculum is almost straight, and forms a right angle with its lower limb. If a

line be taken from the upper end of the gill-opening to the opercular angle, and another line from the latter point to the lower end of the suboperculum, the latter line is three-fourths of the length of the former.

The distance of the origin of the dorsal fin from the occiput equals three-fourths of the distance of the root of its last ray from the caudal. The dorsal fin is longer than high, and possesses fourteen rays, of which the two anterior ones are rudimentary and enveloped in the skin; the third also is covered by the skin and less than half the height of the fourth, which is simple and about equal to the fifth in height; the latter is the first branched ray; the last ray of the fin is cleft to its base.

The length of the base of the anal is somewhat more than two-thirds of the height of that fin; there are twelve anal rays, the two foremost being rudimentary and covered by the skin, the third simple and not quite as long as the fourth, which is branched and, with the fifth, the longest of the fin; the last ray is cleft to the base.

The length of the pectoral fin is equal to that of the distance between the hinder margin of the operculum and the pupil of the eye. Ventral shorter, equal to rather more than half the distance of its root from the vent; its outer ray is in the vertical from the tenth of the dorsal. Hinder margin of caudal truncated.

There are 124 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the first dorsal ray contains twenty-eight scales; that from the adipose forwards to the lateral line has fifteen scales; and there are twenty-three longitudinal series between the lateral line and the root of the ventral. All the scales are rounded posteriorly.

Back brownish green; sides with a reddish tinge; belly dirty white; numerous small X-shaped spots are regularly scattered over the back and sides as far as the darker hue of the upper parts prevails. The immediate neighbourhood of each spot is reddish. Several round blackish-brown spots on the operculum. Dorsal fin with black spots in several series. The other fins immaculate, with a blackish tinge deepening towards the extremity.

Description of a Male Hybrid specimen from the Rhymney, captured in the month of October, with the sexual organs normally developed (probably after second return from the sea).

	inches.
Total length	13
Greatest depth of the body	$2\frac{3}{4}$
Length of the head	$2\frac{3}{4}$
Girth of biggest part of body	$6\frac{1}{2}$
Least depth of the tail	$1\frac{1}{16}$
Girth of narrowest part of tail	$2\frac{3}{4}$
Distance between end of snout and eye	$\frac{7}{8}$
Length of maxillary bone	$1\frac{1}{8}$
Distance between eye and angle of præoperculum	$\frac{7}{8}$
Greatest width of operculum	$\frac{5}{8}$

	inches.
Greatest depth of operculum	1
Distance between occiput and origin of dorsal fin	$3\frac{3}{8}$
Distance between end of dorsal and root of caudal	$4\frac{3}{16}$
Length of base of dorsal	$1\frac{1}{8}$
Greatest height of dorsal	$1\frac{5}{16}$
Length of pectoral	$1\frac{1}{8}$
Distance between root of pectoral and root of ventral	$3\frac{3}{16}$
Length of ventral fin	$1\frac{1}{4}$
Distance between root of ventral and origin of anal	$2\frac{3}{8}$
Length of anal fin	1
Greatest depth of anal	$1\frac{1}{8}$
Length of longest caudal ray	$1\frac{3}{16}$
Length of middle caudal ray	$\frac{7}{8}$

The greatest depth of the body is below the origin of the dorsal fin, and is very little less than one-fourth of the entire length (without caudal); the length of the head bears about the same proportion. The snout is moderately produced, conical, and is a little more than half the length of the postorbital portion of the head; the lower jaw has no hook, and the mouth closes perfectly; the length of the maxillary bone exceeds that of the snout by nearly two-thirds of the diameter of the eye, its greatest width being equal to about one-half of the same.

The maxillary and palatine teeth are considerably smaller than those of the intermaxillary and mandible. The head of the vomer is triangular and broader than long. Of the vomerine teeth there remain three situated on the ridge of the hinder margin of the head of that bone, and three pairs on the longitudinal ridge, one of each pair being bent to the right, the other to the left; there is also a single conical tooth at some distance behind the last of these pairs.

The præoperculum has the whole hinder margin rounded, the lower limb not very distinct, and a shallow notch above the angle. The hinder margin of the operculum is almost straight, oblique, and forms a right angle with its lower limb. A line from the upper end of the gill-opening to the opercular angle exceeds in length another line from the latter point to the lower anterior end of the suboperculum by one-fourth of the latter line.

The distance of the origin of the dorsal fin from the occiput, if carried back from behind that fin, reaches halfway between the adipose and the root of the caudal.

The dorsal fin is a little longer than high, and consists of fourteen rays, of which the first three are rudimentary and enveloped in the skin, the fourth simple, considerably shorter than the fifth, which is also simple and nearly equals the sixth in height, the latter being the first branched ray and the longest of the fin; the last ray is cleft to the base.

The length of the base of the anal fin is one-third of the height of that fin, which consists of eleven rays, the two anterior ones being rudimentary and enveloped in skin, the third simple and equal to the fourth, which is branched; the last ray is cleft to the base.

The length of the pectoral fin slightly exceeds that of the space between the orbit and the angle of the operculum. Ventral shorter than pectoral, a little more than half the length of the distance of its root from the vent; its outermost ray is vertically opposite the eleventh of the dorsal fin. Caudal ray emarginate.

There are 120 transverse series of scales, counting immediately above the lateral line; the series descending from the first dorsal ray backwards to the lateral line contains twenty-eight scales; that from the adipose forward to the lateral line contains sixteen scales, and there are twenty-four longitudinal series between the lateral line and the root of the ventral. All the scales are rounded behind.

Back greenish brown; sides reddish, shining silvery; belly silvery; numerous X-shaped black spots are scattered on the regions above the lateral line; the operculum bears two or three dark-brown spots; the dorsal has two or three series of black spots; the other fins immaculate; the pectoral white, with the outermost ray black along its outer margin, and the extremity of the fin broadly tinged with blackish; caudal and anal blackish.

Description of a Female Hybrid specimen from the Rhymney (probably after second return from the sea).

	inches.
Total length	15½
Greatest depth of the body	2⅞
Length of the head	3
Girth of biggest part of body	7¼
Least depth of the tail	1¼
Girth of narrowest part of tail	3½
Distance between end of snout and eye	⅞
Length of maxillary bone	1⅛
Distance between eye and angle of præoperculum	1
Greatest width of operculum	⅝
Greatest depth of operculum	⅞
Distance between occiput and origin of dorsal fin	4⅝
Distance between end of dorsal and root of caudal fin	5¼
Length of base of dorsal	1¾
Greatest height of dorsal	1⅝
Length of pectoral	2
Distance between root of pectoral and root of ventral	3⅜
Length of ventral fin	1½
Distance between root of ventral and origin of anal	2⅞
Length of anal fin	1¼
Greatest depth of anal	1¾
Length of longest caudal ray	2⅛
Length of middle caudal ray	1 3/16

The greatest depth of the body is below the origin of the dorsal fin, and is a little more than one-fifth of the total length (caudal not included); the length of the head is contained about four times and a half in the same. The snout is scarcely produced, conical, and is

contained twice and one-fifth in the postorbital length of the head; the maxillary is longer than the snout by somewhat more than one-half the diameter of the eye, and extends about one-eighth of an inch behind the vertical from the hinder margin of the orbit, the width of its broadest part is one-half less than the diameter of the eye.

The dentition of the jaws and palate is perfect, the teeth of the mandible being larger than those of the intermaxillary, which, again, exceed slightly those of the maxillary and palatine bones, which are about equal. The vomer has the head triangular, toothless; a series of teeth run along the middle of its body, they are arranged in pairs at some distance from each other, the teeth of each pair being placed one behind the other and not side by side, one being bent towards the right, the other to the left; there are four such pairs.

The distance of the nostrils from the orbit is about two-thirds of the diameter of the latter; the interorbital space is convex, the orbit being far below the upper profile of the head, the width of this space is one-eighth of an inch less than the length of the maxillary bone, and a little more than four-fifths of the length of the space between the pupil and the angle of the præoperculum. The præoperculum has the posterior margin, angle, and lower limb much rounded, the latter being scarcely developed. The posterior margin of the operculum is nearly straight and placed at right angles to the lower margin; the hinder margin of the suboperculum is rounded, its angle very obtuse. A line taken from the upper end of the gill-opening to the angle of the operculum is longer than a line from the latter point to the lower anterior angle of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if carried back from behind that fin, reaches to the hinder third of the distance between the adipose and the root of the caudal. The dorsal fin is rather longer than high, and composed of fifteen rays, the three anterior ones being rudimentary and enveloped in the skin; the fourth ray is simple, and about half the length of the fifth, which is also simple; the fifth and sixth rays are equal, and the longest of the fin, the sixth being the first branched ray. The last ray is cleft to the base. The anal fin is one-fourth higher than long, and composed of twelve rays, the first three being rudimentary and enveloped in skin, the fourth simple, nearly as long as the fifth, which is branched and the longest of the fin; the last ray is split to the base.

Pectoral longer than the postorbital part of the head; ventral shorter, its length being a little more than half of the distance of its root from the vent, its outer ray is in the vertical from the tenth of the dorsal. Posterior margin of caudal very slightly undulated.

There are about 130 transverse series of scales, counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-seven scales, and there are twenty-three or twenty-four longitudinal series between the lateral line and the root of the ventral. The transverse series descending forwards from behind the adipose fin contains fourteen scales: all the scales are obtusely rounded behind.

Back greenish; sides and belly brownish, with a silvery lustre. Scattered black spots, of the size of three or four scales, occupy the sides above the lateral line and sparingly below it; two or three such spots are also found on the operculum. Dorsal with black spots; the other fins immaculate, with a blackish tinge.

Description of a Young Male, caught in the month of August in the Towey.

	inches.
Total length	10¼
Greatest depth of the body	2⅜
Length of the head	2 5/16
Girth of biggest part of body	5¼
Least depth of the tail	5/16
Girth of narrowest part of tail	2¼
Distance between end of snout and eye	⅜
Diameter of the eye	7/16
Length of maxillary bone	1
Distance between eye and angle of præoperculum	13/16
Greatest width of operculum	¼
Greatest depth of operculum	¼
Distance between occiput and origin of dorsal	2¾
Distance between end of dorsal and root of caudal fin	3¼
Length of base of dorsal	1⅛
Greatest height of dorsal	1¼
Length of pectoral	1⅝
Distance between root of pectoral and root of ventral	2⅝
Length of ventral fin	1¼
Distance between root of ventral and origin of anal fin	1⅞
Length of anal fin	⅞
Greatest depth of anal fin	1⅜
Length of longest caudal ray	1½
Length of middle caudal ray	13/16

The greatest depth of the body is below the origin of the dorsal fin, and is a little more than one-fourth of the total length (without caudal); the length of the head is somewhat less than one-fourth of the length of the body. The snout is moderately produced, conical; and its length is rather more than half that of the postorbital part of the head. The length of the maxillary bone exceeds that of the snout by three-fourths the diameter of the eye, its greatest width being equal to one-half of the same.

The dentition of the jaws and palate is perfect; the teeth of the maxillary and intermaxillary are smaller than those of the mandible and palatine bones. The vomerine teeth are strong, and form a complete series from one extremity of the bone to the other, some of them being bent outwards. The interorbital space is somewhat flattened, the eye being immediately below the upper profile of the head. The width of this space is two-sevenths of the length of the head, and two-thirds of the length of the maxillary bone.

The præoperculum has the hinder margin almost straight and vertical, the angle rounded, and the lower limb distinct. The hinder margin of the operculum is also nearly straight, oblique, and placed at a rather obtuse angle to its lower margin. A line from the upper end of the gill-opening to the angle of the operculum is longer than a line from that point to the lower anterior end of the subopercullum.

The distance of the origin of the dorsal fin from the occiput is a little more than half an inch shorter than that of the hinder end of that fin from the caudal. The dorsal fin is higher than long, and is composed of fourteen rays, of which the first three are rudimentary and enveloped in the skin, the fourth simple and slightly shorter than the fifth, which is the first branched ray; the last ray is cleft to its base. The length of the base of the anal fin is rather more than two-thirds of its height. The anal fin has twelve rays, the first three of which are rudimentary and enveloped in skin, the fourth being simple and nearly as high as the fifth, which is the first branched and the longest ray of the fin; the last ray is cleft to the base. The length of the pectoral fin exceeds that of the space between the orbit and the angle of the operculum by about one-fourth of the length of that space. Ventral shorter, reaching about two-thirds of the distance of its root from the vent; its outermost ray is vertically opposite the ninth of the dorsal fin. Caudal slightly emarginate.

There are 120 transverse series of scales, counted immediately above the lateral line; the series extending obliquely backwards from the first dorsal ray to the lateral line contains twenty-seven scales; that from the hinder end of the adipose forward to the lateral line has fourteen scales, and there are twenty-four longitudinal series between the lateral line and the root of the ventral. All the scales are rounded behind.

Back brownish green; sides and belly silvery; numerous roundish reticulated black spots, of about the size of four scales, scattered on the upper parts of the body; several large ones on the operculum; round spots of a bright orange-colour run along the lateral line, a few being scattered below it. Dorsal thickly spotted with large, elliptic, black spots, and with a black and yellow supero-anterior margin. Pectorals and ventrals yellow, with blackish margins. Caudal and anal dusky, the latter with a black and yellow anterior margin.

Description of a Young Female from the Towey, caught in the month of August.

	inches.
Total length	7½
Greatest depth of the body	1½
Length of the head	1 9/16
Girth of biggest part of body	4½
Least depth of the tail	5/16
Girth of narrowest part of tail	1 3/16
Distance between end of snout and eye	3/16
Diameter of the eye	1/8

	inches.
Length of maxillary bone	$\frac{4}{5}$
Distance between eye and angle of præoperculum	$\frac{1}{2}$
Greatest width of operculum	$\frac{3}{5}$
Greatest depth of operculum	$\frac{1}{2}$
Distance between occiput and origin of dorsal fin	$1\frac{3}{4}$
Distance between end of dorsal and root of caudal	$2\frac{1}{2}$
Length of base of dorsal	$\frac{3}{4}$
Greatest height of dorsal	1
Length of pectoral	$1\frac{1}{4}$
Distance between root of pectoral and root of ventral	2
Length of ventral fin	$\frac{7}{8}$
Distance between root of ventral and origin of anal	$1\frac{3}{8}$
Length of anal fin	$\frac{9}{16}$
Greatest depth of anal	$\frac{7}{8}$
Length of longest caudal ray	$1\frac{1}{8}$
Length of middle caudal ray	$\frac{9}{16}$

The greatest depth of the body is below the origin of the dorsal fin, and is one-fourth of the entire length (without caudal); the length of the head is somewhat less. The snout is rather obtuse, and its length is about half that of the postorbital portion of the head. The length of the maxillary bone exceeds that of the snout by two-thirds the diameter of the eye, its greatest width being about half of the same.

The dentition is perfect, the teeth of the intermaxillary and mandible being larger than those of the maxillary and palatine bones. Vomerine teeth strong, forming a single series, the teeth being bent alternately towards the right and left.

The interorbital space is much flattened above, and the eye is situated immediately below the upper profile of the head: the width of this space is nearly one-fourth of the length of the head, and three-fifths of that of the maxillary bone.

The præoperculum has the posterior margin slightly convex and almost vertical, the angle rounded and the lower limb rather feebly developed; the hinder margin of the operculum is straight and oblique, forming a right angle with its lower limb. A line from the upper end of the gill-opening to the opercular angle is only one-sixteenth of an inch longer than another line from that point to the lower anterior angle of the suboperculum.

The distance of the dorsal fin from the occiput, if carried back from behind that fin, reaches only one-eighth of an inch beyond the adipose. The dorsal fin is higher than long, and consists of fourteen rays, of which the first three are rudimentary and covered by the skin, the fourth simple and nearly as long as the fifth; the last ray is cleft to the base. The anal fin is higher than long, and composed of twelve rays, of which the first three are rudimentary and covered by the skin, the fourth simple, the fifth and sixth the longest of the fin, and the last cleft to its base. The pectoral fin is much longer than the space between the orbit and the opercular angle. Ventral shorter than pectoral, reaching about two-thirds of the distance of

its root from the vent; its innermost ray is vertically opposite the eleventh of the dorsal fin. Caudal strongly emarginate.

There are 124 transverse series of scales, counted immediately above the lateral line; that descending obliquely backwards from the origin of the dorsal fin consists of twenty-seven scales; that from the hinder end of the adipose forwards to the lateral line has thirteen scales; and there are twenty-four longitudinal series between the lateral line and the root of the ventral. All the scales are rounded behind.

Back brownish green, fading into silvery on the belly; thickly scattered over with black X-shaped or reticulated spots, each about the size of four scales. A series of bright orange-coloured spots runs along the lateral line, and a few are scattered on the lower part of the sides; the black spots are distinct and numerous on the opercular bones, and very numerous and in many series on the dorsal fin; other fins immaculate and pale-coloured; dorsal with a black and yellow supero-anterior margin; pectoral and ventral yellow; anal with a black and yellow antero-inferior margin.

4. Salmo fario.

Among the numerous variations of the River-Trout, two forms deserve particular attention: one, with fifty-seven or fifty-eight vertebræ, is found in Central Europe and the southern parts of England; the other, with fifty-nine or sixty vertebræ, inhabits the northern parts of Europe, certain parts of Scandinavia, Scotland, and Iceland. In Cumberland, some of the rivers (Caldew, Eden) are inhabited by the southern form, whilst the northern one is found in the River Liddel. However, the latter extends as far southwards as Shropshire, where both forms are met with. Both are subject to the same amount of variation; but the northern form appears to remain within smaller dimensions. The coincidence of the difference in the number of vertebræ with the geographical distribution appears to be remarkable enough to distinguish the two forms; but whether they be regarded as species or varieties is a matter of minor importance.

If we keep them separate, the question arises for which the name of *Salmo fario* should be retained. Linnæus, even if he had been aware of the difference between the northern and southern forms, would scarcely have distinguished them by different names. He formed the name for Scandinavian and German River-Trout, referring especially to the Salmonoid described by Artedi, who attributes to it sixty vertebræ. Artedi also describes the caudal fin as emarginate, having probably taken his description from a young example. Thus the name of *Salmo fario* ought to be retained for the northern form; however, in a case like the present, when the boundary line between species and variety is so obscure, I think it more convenient to adopt a nomenclature indicative of the uncertainty existing.

The synonymy also is often very uncertain, and the following synopsis of synonyms probably contains several references to descriptions taken from species distinct from *S. fario*.

a. Salmo fario gaimardi.

Synonymy for Scandinavian specimens.

Bäck-Forell, Bäckrö.

Salmo no. 3, *Artedi, Synon.* p. 23; no. 5, *Genera*, p. 12; and no. 4, *Species*, p. 51.

Salmo no. 309, *L. Faun. Suec.* p. 117.

Salmo fario, *L. Syst. Nat.* i. p. 509; *Nilsson, Skand. Faun. Fisk.* p. 415.

[? Kröyer, *Danm. Fisk.* ii. p. 625; a trout is described which appears to differ from *S. fario* in several respects, especially in the greater number of pyloric appendages, which amount to 54.]

Salmo punctatus, *Nilsson, l. c.* p. 417.

? Trutta trutta, var. *Malmgren, Findland's Fisk-Fauna*, p. 63.

Salmo trutta, var. *Widegren, Öfvers. Vet. Akad. Förh.* 1862, p. 560, taf. 4. fig. 1 (young), taf. 7. figs. 1 & 2 (half-grown), taf. 8 (adult); *ibid.* 1864, taf. 8 (young), and taf. 13 (adult).

Iceland specimens.

Salmo trutta, *Gaimard, Voy. Isl. & Groenl. Atl. Poiss.* pl. 15. fig. A (the spots incorrectly drawn).

—— gaimardi, *Cuv. & Val.* xxi. p. 341.

Scotch specimens.

Salmo fairo, *Jardine, Edin. New Philos. Journ.* xviii. p. 51 (several northern varieties are indicated in this paper, but no characters of systematic importance are given); Brit. Salmon. pls. 5 & 12; *Parnell, Wern. Mem.* vii. p. 304, pl. 30; or *Fish. Firth of Forth*, p. 144, pl. 30 (not good, maxillary too feeble).

D. 13–14. A. 11–12. P. 14. V. 9. L. lat. 120. L. transv. 27/30. Cæc. pyl. 33–46. Vert. 59–60.

Largest specimen observed, 15 inches; female mature at a length of 7 or 8 inches.

Head well proportioned in its shape, and rather small when compared with the body, body rather short and compressed. The posterior point of junction of operculum and suboperculum is nearly midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum nearly crescent-shaped, without or with a very indistinct lower limb. Snout of moderate length, obtusely conical. Maxillary much longer than the snout, broad and stout; in male specimens, 9 inches long, it extends to or nearly to the vertical from the hind margin of the orbit. Teeth of moderate size. The head of the vomer is triangular, small, broader than long; vomerine teeth in a double series, sometimes disposed in a zigzag line, persistent throughout life. Fins well developed. The caudal fin of specimens of 9 inches in length is truncate or scarcely emarginate, the middle caudal rays being more than half as long as the outer ones. The hind part of the body is short, and rather high; there are about fifteen scales in a transverse series from behind the adipose fin obliquely forwards to the lateral line.

Sides with numerous round or X-shaped black markings; the upper surface and sides of the head, the dorsal, adipose, and caudal

fins generally with crowded round black spots; dorsal, anal, and ventral with a black and white outer edge.

Iceland; North Britain; Ireland; Scandinavia.

a–d. Fine specimens, two sterile, 11 inches long, and two males 9 inches long. Iceland. Presented by G. G. Fowler, Esq. Vert. 60; cæc. pyl. 43–46.

e, f–g, h–i. Adult and half-grown. Eidfjord River (Hardanger Fjord). Presented by Prof. N. St. Maskelyne. Vert. 59–60.

k. Adult. River above the Vöring Foss, Norway. Presented by Prof. N. St. Maskelyne.

l–m. Male, 17 inches long, with a small mandibulary hook, and female, 9½ inches long, with mature ova. Jutland. Presented by the Copenhagen Museum. Caught in November; cæc. pyl. 41; vert. 60.

n–o. Adult. Lakes near Dunskey, Port Patrick. Presented by Dr. P. L. Sclater. (October.)

p–q, r–s. From 11 to 13 inches long. River Tweed. Presented by Mr. G. Smith. (September 29th.)

t–w. From 5 to 9 inches long. River Tweed. Presented by His Grace the Duke of Roxburgh.

x, y. Male and female, 13 and 10 inches long. Lossie River, Moray Firth. Presented by Captain J. B. Dunbar.

z–δ. From 4 to 10 inches long. River Dee, near Abergeldie Castle. Presented by Th. Günther, M.D. Vert. 60; cæc. pyl. 44.

ε–ζ. Skins. North Esk, Forfarshire. From Mr. Parnell's Collection.

ι–κ. Skins. South Esk, Forfarshire. From Mr. Parnell's Collection.

λ. Numerous examples; skins. River Forth. From Mr. Parnell's Collection.

μ. Skin. River Esk, Edinburgh. From Mr. Parnell's Collection.

ν. Numerous examples; skins. River Clyde, taken above and below the falls. From Mr. Parnell's Collection.

[The *Trout of the Clyde* forms a very well marked variety, distinguished by a short body, very short snout, broad maxillary, strong vomerine teeth, small anal fin, and numerous fine X-shaped markings on the body; the spots on the dorsal fin are small, ovate, numerous.]

ξ. Numerous examples; skins. River Annan. From Mr. Parnell's Collection.

o. Skin. Solway. From Mr. Parnell's Collection.

π, ρ, ς, τ. Adult and young. Scotland? Purchased of Mr. Stevens. Vert. 59; cæc. pyl. 35.

υ–ψ. Adult. River Liddel, Cumberland. Purchased of Mr. Wright. Vert. 59.

ω–aa. Half-grown. River Esk, Cumberland. Purchased of Mr. Wright.

bb–cc. Adult. River Heather, a tributary of the Lyne. Purchased of Mr. Wright. Vert. 59.

dd. Male, 15 inches long. Shropshire, near Wellington. Presented by T. C. Eyton, Esq. Vert. 60; cæc. pyl. 33.

ee, ff. Many specimens. Rivers Owenbrean and Sacrapagh, Fermanagh. Presented by the Earl of Enniskillen.

gg. Many specimens. Mountain-lake near Galway Bay. Presented by F. Godman, Esq.

Specimens illustrating the growth of this species.

hh. A series of specimens from the Tweed and Esk, from 1 to 3 inches long.

Deformed specimens.

ii. Upper part of the snout shortened. Old Collection.

kk. Upper part of the snout shortened. Loch Roy, Invernesshire. Presented by H. C. Pennell, Esq.

ll. Vertebral column forming an undulating curve. Old Collection.

Description of a Male specimen from the Dee (Aberdeen), caught in the month of September (testicles fully developed).

	inches.
Total length	10⅜
Greatest depth of the body	1⅞
Length of the head	2⅜
Girth of the biggest part of the body	4½
Least depth of the tail	⅞
Girth of narrowest part of tail	2¼
Distance between end of snout and eye	⅝
Diameter of the eye	7/16
Length of the maxillary bone	1
Distance between eye and angle of præoperculum	⅞
Greatest width of operculum	½
Greatest depth of operculum	¾
Distance between occiput and origin of dorsal fin	3
Distance between end of dorsal and root of caudal	3⅜
Length of base of dorsal	1
Greatest height of dorsal	1⅜
Length of pectoral	1⅝
Distance between root of pectoral and root of ventral	2⅝
Length of ventral fin	1 3/16
Distance between root of ventral and origin of anal	1⅞
Length of anal fin	¾
Greatest depth of anal	1¼
Length of longest caudal ray	1½
Length of shortest caudal ray	¾

The greatest depth of the body is below the origin of the dorsal fin, and is one-fifth of the total length (caudal not included); the length of the head is contained three times and three-quarters in that of the body. The snout is moderately produced, pointed, and half the length of the postorbital portion of the head.

The length of the maxillary bone is equal to that of the snout

together with the diameter of the eye, its greatest width being about one-half of the same. The lower jaw is slightly bent upwards, and is without hook.

The teeth of the mandible, intermaxillary, and palatine bones are larger than those of the maxillary; the vomerine teeth are disposed in an almost completely double series. The interorbital space is flat, with a rather elevated median ridge, the eye being placed somewhat below the upper profile; the width of this space is equal to one-half the length of the postorbital part of the head, or two-thirds of that of the maxillary bone.

The posterior margin of the præoperculum is convex, the lower limb being rather indistinct; the posterior margin of the operculum is straight, and forms a right angle with the lower limb. A line from the upper end of the gill-opening to the angle of the operculum is a little longer than a line from that point to the lower anterior end of the suboperculum. The suboperculum is nearly thrice as long as broad. The distance of the dorsal fin from the occiput, if measured back from behind that fin, reaches to midway between the adipose and the root of the caudal fin. The dorsal fin is a little higher than long, and consists of thirteen rays, the first three being rudimentary, the fourth simple, and the fifth and sixth branched, and the longest of the fin.

The anal fin is not quite twice as high as long, and consists of eleven rays, the two first being rudimentary, the third simple, the fourth the first branched ray, and the sixth the longest of the fin.

The pectoral fin is one-fourth of an inch longer than the post-orbital portion of the head, or than one-half of its distance from the ventral; the ventral fin is much shorter, and reaches two-thirds of the distance from its root to the vent; its outermost ray is in the vertical from the tenth of the dorsal. Caudal nearly truncated, with the lower lobe rounded.

There are 124 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to the lateral line has twenty-six scales; that from the hinder end of the adipose forwards to the lateral line has sixteen scales; there are twenty-two longitudinal series between the lateral line and the root of the ventral. Scales rounded, without median ridge.

Back and sides greenish brown, belly brownish white; numerous reticulated black spots about the size of four scales are scattered along the sides above and below the lateral line. A series of orange-coloured spots runs along the lateral line, and others are scattered below it. Opercular bones with many large, round, black spots. Dorsal with densely crowded, oval, black spots in several series, and with a black and yellow supero-anterior margin; anal dusky, with a broad black and yellow margin anteriorly; pectorals and ventrals with a blackish tinge, the latter with an outer black and yellow margin; caudal blackish.

Pyloric appendages forty-four.

b. Salmo fario ausonii.

Synonymy of German specimens.

Forelle.
Trutta fluviatilis, *Gesner*, p. 1203.
Salmo no. 367, *Gronov. Zoophyl.* p. 120; no. 370, p. 121 (young).
Trutta no. 9, *Klein, Pisc. Miss.* v. p. 19, tab. 1. fig. 3.
Salmo fario, *Bloch*, i. p. 148, taf. 22, & p. 157, taf. 23; *Schrank, Faun. Boic.* i. p. 320; *Meidinger*, pl. 20; *Agass. Poiss. d'eau douce*, pl. 3–5; *Günth. Fische des Neckars*, p. 113.
Salmo alpinus, *Bloch*, iii. p. 158, taf. 104.
—— saxatilis, *Schrank, Faun. Boic.* i. p. 320.
Salar ausonii, *Heckel, Sitzgsber. Acad. Wiss. Wien*, 1852, viii. p. 354, taf. 8; *Heckel & Kner, Süsswasserf.* p. 248.
Trutta fario, *Siebold, Süsswasserf.* p. 319.
Anatomy: Agass. & Vogt, Mem. Soc. Sc. Nat. Neuchâtel, iii.; Kner, Sitzgsber. Acad. Wiss. Wien, 1851, vi. p. 243, & 1852, viii. p. 204.

Russian specimens.

Salmo fario, *Pall. Zoogr. Ross.-As.* iii. p. 348.

British specimens.

The Common River-Trout.
Trutta fluviatilis, *Willughby*, p. 199 (p. 193, two varieties are mentioned by Johnson, but in very indistinct terms).
Trout, *Borlase, Cornwall*, p. 263, t. 26. f. 1; *Pennant, Brit. Zool.* iii. p. 260, pl. 59, & edit. 1812, iii. p. 399, pl. 70.
Salmo fario, *Turt. Brit. Faun.* p. 103; *Donov. Brit. Fish.* iv. pl. 85; *Flem. Brit. Anim.* p. 181; *Richards. Faun. Bor.-Amer. Pisc.* p. 144, pl. 92. fig. 3 A & B; *Jenyns, Man.* p. 424; *Yarr. Brit. Fish.* 2nd edit. ii. p. 85, & 3rd edit. i. p. 261.
Salmo cornubiensis, *Walb. Artedi*, iii. p. 65; *Bl. Schn.* p. 421.

French specimens.

Salar Gallorum Trutta, *Bellon.* p. 280.
Trutta fluviatilis, *Rondel.* ii. p. 169.
Salmo fario, *Sélys-Longchamps, Faune Belge*, p. 221.
Salar ausonii, *Cuv. & Val.* xxi. p. 319, pl. 618.

D. 13 (–14). A. 10–11. P. 13. V. 9. L. lat. 120. L. transv. 26/30. Cæc. pyl. 38–47 (–51). Vert. 57*, 58.

Attaining to a length of thirty inches; female mature at a length of eight inches.

Head well proportioned in its shape; body rather stout. The posterior point of junction of operculum and suboperculum is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum with a not very indistinct but very oblique lower limb. Snout rather produced in the male; the lower jaw having a hook in front in very old examples only. Maxillary much longer than the snout, very strong and dilated (see p. 6); it extends to below the hinder margin of the orbit already in specimens of eight or nine inches in length. Dentition strong. The head of the vomer is triangular, much broader than long, with

* Fifty-six, if the last rudimentary caudal vertebra be not counted.

a transverse series of teeth across its base; body of the vomer with a double series of strong teeth, the teeth being placed either opposite to each other or alternately; this series of teeth is persistent throughout life. Fins comparatively short and rounded: the length of the pectoral is one-half, or rather less than one-half, of the distance of its base from that of the ventral; in specimens under 10 inches it is somewhat longer. The caudal fin is emarginate in young examples, but has become truncate in specimens of eight inches in length, in which the length of the middle caudal rays is only two-thirds of that of the outer ones. The hind part of the body is short and rather high; there are about sixteen scales in a transverse series descending from behind the adipose fin obliquely backwards to the lateral line.

Body, head and dorsal fin generally with numerous red and black spots; a part of the latter have generally a light edge; these black spots are either round or more irregular in shape, composed of X-shaped marks. Anterior margin of the dorsal and anal, and the outer one of the ventrals, generally yellowish.

A non-migratory species, inhabiting numerous fresh waters of Central Europe, Sweden and England; rivers of the Maritime Alps.

a. Fine specimen. Scar River, Caldew. Purchased of Mr. Wright.

b, *c–f*. Fine specimens. River Caldew, Cumberland. Purchased of Mr. Wright. Vert. 58.

g–i. Fine specimens. River Eden. Purchased of Mr. Wright. Vert. 58.

k–l. Fine specimens. River Fething, tributary of the Eden. Purchased of Mr. Wright.

m–p. Fine specimens. River Derwent. Purchased of Mr. Wright. Vert. 58.

q–r. Eight inches long. Troutbeck River, Westmoreland. Purchased of Mr. Wright.

s–u. Seven inches long. Dalebeck River. Purchased of Mr. Wright.

v–x. Fine specimens. Port Sodrick, Isle of Man. Purchased of Mr. Wright.

y–β. Fine specimens. Kirk St. Anne, Isle of Man. Purchased of Mr. Wright. Vert. 58.

γ–δ. Fine specimens. Island of Islay. Presented by W. J. Ffennell, Esq. This variety resembles closely the Gwyniad of the Ewenny.

ε, *η–θ*. Sterile specimens, 14 inches long. River Ewenny (tributary of the Ogmore), Glamorganshire. Presented by the Rev. E. P. Nicholl. Caught in May. "Gwyniad."

ζ. Sterile female fish, 15 inches long. River Usk, near Brecon. Presented by J. Lloyd, Esq., Jun. Vert. 58.

ι. Many male, female, and sterile specimens, from 7 to 13 inches long. River Usk, near Brecon. Presented by J. Lloyd, Esq., Jun. Vert. 58. Cæc. pyl. 40–45.

κ, *λ–ξ*. Seven inches long, and young. Goodwick, near Haverfordwest. Presented by Hugh C. Owen, Esq.

o, *π*, *ρ–s*. From 7 to 9 inches long. Rhymney. Presented by the Rev. A. Morgan. Vert. 58.

τ. Male, 19 inches long (overgrown). Tributary of the Severn near Wellington, Shropshire. Presented by T. C. Eyton, Esq. Vert. 58. Cæc. pyl. 38.

υ. Female, 19 inches long (barren). River Chess, Buckinghamshire. Presented by F. Gould, Esq. Vert. 58. Cæc. pyl. 41.

φ. Many specimens. River Glaven, near Hanworth. Presented by J. H. Gurney, Esq.

ψ–ω, *aa–dd*. Adult and young. River Itchen (Hampshire). Presented by T. Chamberlayne, Esq.

ee. Male, 15½ inches long. Hurstbourne Park, Hampshire. Presented by Lord Portsmouth. Cæc. pyl. 47. Vert. 57.

ff. Sterile male fish, 14 inches long. Hurstbourne Park. Presented by Lord Portsmouth. Vert. 57.

gg. Male, 29 inches long (overgrown and barren). Cobham, near Maidenhead. Presented by F. Gould, Esq.

hh. Male, 26 inches long (overgrown and barren). River Colne. Presented by F. Gould, Esq.

ii. Male, 27 inches long, stuffed. Thames, near Hampton Court.

kk–qq. Fine specimens, from 10 to 14 inches long. River Wandle. Presented by Alfred Smee, Esq., M.D. These specimens were obtained whilst engaged in spawning, on the 7th of March.

Male, 14 inches long: 39 cæc. pyl., and 58 vertebræ.
Female, 13 inches long: 41 cæc. pyl., and 57 vertebræ.
Male, 11 inches long: 41 cæc. pyl.
Female, 12 inches long: 42 cæc. pyl., and 58 vertebræ.
Female, 10 inches long: 47 cæc. pyl.
Male, 9½ inches long: 49 cæc. pyl., and 57 vertebræ.
Male, 12 inches long: 51 cæc. pyl.

It must be remarked that Dr. Smee has introduced into this river numerous Trout artificially bred from ova which were received from various sources.

rr. Skin. Poole, Hants. From Mr. Yarrell's Collection.

ss. Skin. Wareham, Dorset. From Mr. Yarrell's Collection.

tt. Skin. River Dart, South Devon. From Mr. Yarrell's Collection.

uu. Young. River Torridge, Devon. Presented by Dr. A. Günther.

vv. Many skins from the River Plym, not in good state. From the Collections of Mr. Yarrell and of Lieut. H. F. Spence, R.N.

ww. Skin. River Erme. Presented by Lieut. H. F. Spence. Cæc. pyl. 44.

xx. Skin. Penzance. From Mr. Yarrell's Collection.

yy-zz. Sterile specimens, 9 inches long. London Market. Vert. 58.

αα. Male, sterile, 15 inches long. River Gotha (Sweden). From Mr. Lloyd's Collection. Vert. 58; cæc. pyl. 48.

ββ. Male, 11 inches long. Harzgerode, Harz. Presented by Hr. R. Blasius. Vert. 56.

γγ–δδ. From 6 to 8 inches long. Mulde River, near Brestewitz. Presented by Hr. R. Blasius. Vert. 56.

εε–ηη. Male and female, 14 and 15 inches long. Brenz, tributary of the Upper Danube. From the Stuttgart Museum. Vert. 57.

θθ. Female, 8 inches long. Erms tributary of the Neckar. From the Stuttgart Museum. Vert. 57.

ζζ. Seven inches long. Frankstadt in Mähren. From Mr. Jeitteles's Collection. Vert. 58.

ιι*. Female, 15 inches long. Lake of Constance. Presented by Prof. v. Siebold.

κκ. Adult female. Col de Tende (Maritime Alps). From Dr. Deakin's Collection. Vert. 57; cæc. pyl. 47.

λλ–μμ. Young. San Martino, river Var. From Dr. Deakin's Collection.

Deformed examples.

νν. Nine inches long. Bankend River. Purchased of Mr. Wright.

ξξ. Eight inches long. Caldbeck River. Purchased of Mr. Wright. In both these examples the caudal portion of the vertebral column is curved in the shape of an S.

Description of a large male Thames-Trout caught in the month of May.

	inches.
Total length	28½
Greatest depth of the body	6⅝
Length of the head	7½
Girth of biggest part of the body	16
Least depth of the tail	2¼
Distance between end of snout and eye	3
Diameter of the eye	¾
Length of the maxillary bone	3 7/16
Distance between eye and angle of præoperculum	2⅝
Greatest width of operculum	1¼
Greatest depth of operculum	2⅜
Distance between occiput and origin of dorsal fin	9
Distance between end of dorsal and root of caudal	9½
Length of base of dorsal	2⅝
Greatest height of dorsal	3 5/16
Length of pectoral	4

* This specimen is one to which some interest is attached; it has been sent to us by Prof. v. Siebold with the name of "*Trutta lacustris*, fem., with the sexual organs developed," and is said to be from the Lake of Constance. It is, in my opinion, nothing but a *Salmo fario*, a species not mentioned by Rapp or Siebold as an inhabitant of that lake; it differs scarcely from other specimens obtained in Southern Germany; and, to remove every doubt of its being *S. fario*, and not the lake-species as believed by Siebold, I may further mention that it has 57 vertebræ, and not 60; the number of its pyloric appendages is 43, a number more frequently found in *S. fario* than in the other lake-species.

Thus it appears that *S. fario* inhabits the Lake of Constance; probably it has often been confounded with *Salmo rappii* (*S. trutta*, Rapp); and this may account for a number of divergent statements as regards the number of pyloric cæca, their habits, etc.; thus we suppose that the specimen, the pyloric appendages of which have been examined by Kner (Sitzgsber. Akad. Wiss. Wien, 1852, viii. p. 208), belongs to this variety of *S. fario* rather than to *S. lacustris*; likewise the specimen the vomerine teeth of which have been figured by Heckel (ibid. p. 353, taf. 7. figs. 4, 5).

	inches.
Distance between root of pectoral and root of ventral	$6\frac{1}{2}$
Length of ventral fin	$3\frac{7}{16}$
Distance between root of ventral and origin of anal	$4\frac{7}{8}$
Length of anal	$2\frac{1}{8}$
Greatest depth of anal	$3\frac{1}{2}$
Length of longest caudal ray	$3\frac{1}{2}$
Length of middle caudal ray	$2\frac{3}{4}$

The body of this specimen is short and extremely stout; the head and jaws strongly developed, but less so than in the specimen from Shropshire.

The greatest depth of the body is below the origin of the dorsal fin, and is not quite one quarter of the total length (without caudal); that of the head is three-tenths of the same. Snout much produced, pointed, equal in length to four-fifths of the length of the postorbital portion of the head, or five-sixths of the maxillary bone; the lower jaw has a terminal hook, much developed, and half an inch in height, received into a deep depression in the extremity of the upper jaw: the jaws do not meet laterally, and the external teeth of the upper jaw are nowhere in contact with those of the mandible. The maxillary bone is longer than the snout by half the diameter of the eye; it extends far beyond the vertical from the posterior margin of the orbit, and its greatest width is two-thirds of the diameter of the eye.

Dentition very perfect; teeth strong; those of the mandible and intermaxillary being larger and stronger than those of the maxillary and palatine bones; the vomerine teeth do not reach far backwards on the palate; but those which remain are disposed in a double series. The interorbital space is convex, being equal to two-thirds of the length of the postorbital part of the head, or five-sevenths of that of the maxillary bone: the eye is small, and placed slightly below the upper profile of the head.

The præoperculum has its posterior margin subvertical, somewhat rounded, and the lower limb very indistinct; the hinder margin of the operculum is straight, and the angle which it forms with the lower limb is an obtuse one. The suboperculum is broad, little more than twice as long as broad. The distance between the upper end of the gill-opening and the angle of the operculum is more than that between the latter point and the lower anterior end of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if measured back from behind that fin, reaches two-thirds of the distance between the adipose and the root of the caudal. The dorsal fin is higher than long, and consists of fourteen rays, of which the anterior four are rudimentary and covered by the skin, the fifth simple and nearly as long as the sixth, which is branched and the longest of the fin: the terminal ray is cleft to its base.

The anal fin is much higher than long; it consists of eleven rays, of which the first and second are rudimentary and covered by the skin, the third simple and much shorter than the fourth, which is the first branched ray; the last ray is cleft throughout.

Pectoral rather longer than the postorbital part of the head, and

reaching rather more than half of the distance between its root and that of the ventral fin: ventral shorter, reaching about three-fourths of the distance between its root and the vent; its outermost ray is vertically opposite to the tenth of the dorsal fin. All the fins except the dorsal show signs of some check having affected their growth, causing irregularity in the outer rays. Posterior margin of caudal convex.

There are 120 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to that line contains 29 scales, that forwards from behind the adipose has 15 scales. There are 23 longitudinal series of scales between the lateral line and the ventral fin.

The skin of the back is very thick, enveloping the scales of that region.

Sides of the body and head and the dorsal fin with numerous, small, round, black spots.

The testicles of this specimen are reduced to a thin band, as is the case in sterile fish.

Description of a male specimen from Hampshire, caught in the month of January (testicles fully developed).

	inches.
Total length	16
Greatest depth of the body	3 5/6
Length of the head	3 1/2
Girth of biggest part of body	8
Least depth of the tail	1 3/8
Girth of narrowest part of tail	3 1/8
Distance between end of snout and eye	1 1/8
Diameter of the eye	5/8
Length of maxillary bone	1 1/2
Distance between eye and angle of præoperculum	1 5/6
Greatest width of operculum	1 1/4
Greatest depth of operculum	1 1/8
Distance between occiput and origin of dorsal fin	4 3/8
Distance between end of dorsal and root of caudal	4 3/8
Length of base of dorsal	1 3/4
Greatest height of dorsal	2 1/8
Length of pectoral	2 1/8
Distance between root of pectoral and root of ventral	4 1/4
Length of ventral fin	1 3/6
Distance between root of ventral and origin of anal	2 1/2
Length of anal fin	1 3/8
Greatest depth of anal	1 3/6
Length of longest caudal ray	2 1/8
Length of middle caudal ray	1 1/4

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and one-fourth in the total length, not including the caudal fin. The length of the head is rather more

than one-fourth of that of the body. The snout is somewhat produced, rather pointed, and more than half the length of the postorbital part of the head. The length of the maxillary bone exceeds that of the snout by three-fourths of the diameter of the eye, its greatest width being more than half of the same. The lower jaw is slightly bent upwards, with a trace of a hook, and the contact of the upper and lower jaws is imperfect. The teeth are strong, those of the mandible and palatine bones being the strongest, the teeth on the vomer are arranged in a double series, which, however, is much deranged in consequence of about one-half of the teeth being in process of changing; four teeth stand in a transverse series on the hinder part of the head of the vomer.

The interorbital space is but slightly convex, and the eye is situated a little below the upper profile of the head; the width of this space is two-sevenths of the length of the head, and two-thirds of that of the maxillary bone. The maxillary extends slightly beyond the vertical from the hinder margin of the orbit.

The præoperculum has its hinder margin irregularly convex, and considerably inclined backwards, scarcely any angle, and the lower limb very indistinct. The hinder margin of the operculum is slightly convex, very oblique, and forms a rather obtuse angle with the lower margin, which is distinctly rounded. A line from the upper end of the gill-opening to the angle of the operculum is equal to another line from that point to the lower anterior end of the subopercular. Suboperculum twice as long as high.

The dorsal fin is equally distant from the occiput and the root of the caudal; it is higher than long, and composed of thirteen rays, the first two being rudimentary, and covered by the skin, the third simple and a little shorter than the fourth, which is branched; the last is cleft to the base.

The anal fin is about two-thirds as long as high, and consists of twelve rays, the two anterior ones being rudimentary and covered by the skin, the third simple and half as long as the fourth, which is also simple, and nearly as long as the next; the last ray cleft to the root.

The pectoral fin is one-eighth of an inch longer than the postorbital part of the head. Its outer rays, towards their extremities, show signs of some check having affected their growth. It is rounded, and its length is less than one-half of its distance from the ventral fin. The ventral fin is shorter than the pectoral, and reaches to three-fourths of the distance of its root from the vent; its outermost ray is vertically opposite to the tenth of the dorsal. Caudal truncated, short, with the lobes rather obtuse.

There are 127 transverse rows of scales, counted immediately above the lateral line: the series descending obliquely backwards from the origin of the dorsal fin to the lateral line has thirty-one scales; that from the hinder end of the adipose backwards to the lateral line has sixteen scales: there are twenty-seven longitudinal series between the lateral line and the root of the ventral fin. All the scales are rounded behind, without median ridge.

Back greenish-brown, fading to brownish-white on the sides; belly blackish; irregular black spots of about the size of two or three scales are scattered on the sides; a series of bright purple-coloured spots runs along the lateral line, a few being scattered on the lower part of the side; there are several distinct black spots on the operculum, and several series of elliptical ones on the dorsal fin and caudal fin; the other fins are immaculate, the anal blackish, the pectorals and ventrals yellowish, tinged and margined with blackish.

The state of the sexual organs shows that the specimen was engaged in propagating its species at the time of capture.

Description of a male overgrown Trout, taken in a small rivulet in Shropshire in the month of April; testicles very small, band-like.

	inches.
Total length	20
Greatest depth of the body	$3\frac{7}{8}$
Length of the head	$5\frac{3}{4}$
Girth of the biggest part of the body	$9\frac{3}{4}$
Least depth of the tail	$1\frac{1}{2}$
Distance between end of snout and eye	2
Diameter of the eye	$\frac{5}{8}$
Length of the maxillary bone	$2\frac{5}{8}$
Distance between eye and angle of præoperculum	2
Greatest width of operculum	$1\frac{1}{8}$
Greatest depth of operculum	$1\frac{5}{8}$
Distance between occiput and origin of dorsal fin	$5\frac{3}{16}$
Distance between end of dorsal and root of caudal	$5\frac{2}{16}$
Length of base of dorsal	2
Greatest height of dorsal	$2\frac{1}{8}$
Length of pectoral	$2\frac{5}{8}$
Distance between root of pectoral and root of ventral	5
Length of ventral fin	$2\frac{1}{8}$
Distance between root of ventral and origin of anal	$3\frac{3}{4}$
Length of anal	$1\frac{5}{8}$
Greatest depth of anal	$2\frac{1}{8}$
Length of longest caudal ray	$2\frac{1}{4}$
Length of middle caudal ray	$1\frac{5}{8}$

The specimen is in a very lean condition, with the head of enormous dimensions; the jaws exceedingly large and strong; and the maxillary bone strongly undulated, reaching far beyond the hinder margin of the orbit. Although the sexual organs are very feebly developed, the skin on the back is extremely thick, covering the scales.

The greatest depth of the body is below the origin of the dorsal fin, and is two-ninths of the total length (caudal not included); the length of the head is one-third of the same. The snout is much produced and pointed, and two-thirds the length of the postorbital part of the head, or nearly three-fourths that of the maxillary bone. The lower jaw projects considerably beyond the upper, being bent upwards at the extremity, but no part of it is received between the

intermaxillary bones. The maxillary bone is longer than the snout by four-fifths of the diameter of the eye.

The dentition is quite perfect; the teeth remarkably strong: those on the longitudinal part of the vomer reach very far back on the palate: those of the mandible and intermaxillary are about equal and larger than those of the maxillary and palatine bones.

The distance of the nostrils from the orbit is about one-third of the diameter of the latter. The interorbital space is flattened; the position of the eye slightly below the upper profile of the head: the width of this space is less than the length of the snout, and more than half that of the postorbital part of the head.

The præoperculum has no lower limb, being obtusely rounded below; the posterior margin of the operculum is slightly undulated, and very oblique; the angle at which it meets the lower limb being a right one. The distance between the upper end of the gill-opening and the angle of the operculum is greater than that between the latter point and the lower anterior end of the suboperculum.

The dorsal fin is equally distant from the occiput and the root of the caudal. It is one-eighth of an inch higher than long, and possesses fourteen rays, of which the first three are rudimentary and covered by the skin, the fourth simple and not much shorter than the next, which is branched and reaches the utmost height of the fin; the final ray is cleft throughout.

The anal fin is higher than long, its length being about two-thirds of its height. It consists of twelve rays.

Pectoral fin almost equal in length to the postorbital part of the head, reaching about half the distance of its root from that of the ventral; the latter fin is shorter, and reaches more than midway towards the vent; its outermost ray is vertically opposite to the ninth of the dorsal. The posterior margin of the caudal fin is convex.

There are 120 transverse series of scales, counted immediately above the lateral line: the series descending obliquely backwards from the origin of the dorsal fin to that line has twenty-three or twenty-four scales; that from behind the adipose forward to the lateral line has fifteen scales; there are twenty-three longitudinal series between the lateral line and the root of the ventral.

Head and upper parts dark brown; sides and belly greyish brown; sides with orange-coloured and red round spots in moderate number. Fins blackish.

Vertebræ 58. Cæca pylorica 38.

Description of a Male specimen from the Brenz, a tributary of the Upper Danube, caught after the spawning-time.

	inches.
Total length	14¼
Greatest depth of the body	2⅝
Length of the head	3⅝
Girth of biggest part of body	6½
Least depth of the tail	1¼
Girth of narrowest part of tail	3⅛

	inches.
Distance between end of snout and eye	1
Diameter of the eye	$\frac{1}{2}$
Length of the maxillary bone	$1\frac{2}{3}$
Distance between eye and angle of præoperculum	$1\frac{7}{16}$
Greatest width of operculum	$\frac{7}{8}$
Greatest depth of operculum	$1\frac{1}{8}$
Distance between occiput and origin of dorsal fin	4
Distance between end of dorsal and root of caudal	$4\frac{1}{2}$
Length of base of dorsal	$1\frac{7}{8}$
Greatest height of dorsal	$1\frac{2}{3}$
Length of pectoral	$1\frac{7}{8}$
Distance between root of pectoral and root of ventral	$3\frac{2}{3}$
Length of ventral fin	$1\frac{1}{2}$
Distance between root of ventral and origin of anal	$2\frac{7}{8}$
Length of anal fin	$\frac{7}{8}$
Greatest depth of anal	$1\frac{1}{2}$
Length of longest caudal ray	$1\frac{7}{8}$
Length of middle caudal ray	$1\frac{1}{4}$

The greatest depth of the body is below the origin of the dorsal fin, and is contained four times and a half in the total length (without caudal); the length of the head is contained three times and a half in the same. The snout is considerably produced, obtusely conical at the extremity, and more than half as long as the postorbital portion of the head; the length of the maxillary bone is equal to that of the snout together with the entire diameter of the eye, its greatest width being rather more than half that diameter. The lower jaw is very slightly bent upwards, having a very faint trace of a hook; when the mouth is closed the maxillary does not come into perfect contact with the mandible.

The teeth are strong and conical, those of the mandible, intermaxillary, and palatine bones being stronger and larger than those of the maxillary. The head of the vomer is triangular, much broader than long, and bears four teeth on the ridge of its hinder margin; the remainder of the teeth are arranged along the median longitudinal ridge in a double, or rather zigzag, series, one of each pair being in advance of the other.

The interorbital space is but slightly convex, the eye being situated not far beneath the upper profile of the head; the width of this space is equal to the length of the snout, or two-thirds of that of the maxillary bone. The maxillary reaches beyond the vertical from the hinder margin of the orbit.

The hinder margin of the præoperculum is slightly convex, inclining backwards, with the angle and lower limb rounded, the latter not very distinct. The posterior margin of the operculum is almost straight, rounded off towards the angle, which is an obtuse one. The distance from the upper end of the gill-opening to the angle of the operculum is equal to that from the latter point to the lower anterior end of the suboperculum. Suboperculum more than twice as long as high.

The distance from the dorsal fin to the occiput, if measured back from behind that fin, reaches midway between the adipose and the root of the caudal fin. The dorsal fin is higher than long, and consists of fourteen rays, the first four being rudimentary, the fifth simple and as long as the sixth, which is branched, the terminal ray cleft to the root.

The anal fin is two-thirds as long as high, and consists of ten rays, the first two of which are rudimentary, the third simple and as long as the fourth, the last ray cleft throughout.

The pectoral fin is one-fourth of an inch shorter than the postorbital portion of the head; its length is one-half of its distance from the ventral fin.

The ventral fin is shorter than the pectoral, reaching more than midway between its root and the vent; its outermost ray is opposite to the tenth of the dorsal fin. Caudal truncated.

There are 120 transverse series of scales, counted immediately above the lateral line; the series descending backwards from the origin of the dorsal fin to the lateral line has twenty-six scales; that from the hinder end of the adipose forwards to the lateral line has sixteen scales: there are twenty-two longitudinal series between the lateral line and the ventral fin. All the scales rounded, without median ridge; those on the back are enveloped in a rather thick skin.

Back greenish brown, becoming more silvery on the sides; belly brownish; sides with numerous reticulated black spots, between which red ones are interspersed; opercular bones with a few black spots. Dorsal fin with several series of large oval black spots; anal and caudal blackish; pectorals and ventrals pale-coloured, with blackish tinge. Dorsal, anal, and ventral fins with a very narrow whitish outer edge.

Pyloric appendages forty-seven.

Description of a Female specimen from the Brenz, caught after the spawning-time.

	inches.
Total length	13$\frac{1}{8}$
Greatest depth of the body	2$\frac{3}{8}$
Length of the head	2$\frac{3}{4}$
Girth of biggest part of body	5$\frac{1}{2}$
Least depth of the tail	1$\frac{1}{8}$
Girth of narrowest part of tail	2$\frac{3}{4}$
Distance between end of snout and eye	$\frac{3}{4}$
Diameter of the eye	$\frac{1}{2}$
Length of maxillary bone	1$\frac{1}{4}$
Distance between eye and angle of præoperculum	1
Greatest width of operculum	$\frac{5}{8}$
Greatest depth of operculum	$\frac{7}{8}$
Distance between occiput and origin of dorsal fin	3$\frac{3}{4}$
Distance between end of dorsal and root of caudal	4$\frac{1}{4}$
Length of base of dorsal	1$\frac{3}{8}$
Greatest height of dorsal	1$\frac{1}{2}$

	inches.
Length of pectoral	$1\frac{3}{4}$
Distance between root of pectoral and root of ventral	$3\frac{9}{16}$
Length of ventral fin	$1\frac{1}{2}$
Distance between root of ventral and origin of anal	$2\frac{3}{4}$
Length of anal fin	$1\frac{1}{16}$
Greatest depth of anal	$1\frac{3}{4}$
Length of longest caudal ray	$1\frac{7}{8}$
Length of middle caudal ray	$1\frac{1}{16}$

The greatest depth of the body is below the origin of the dorsal fin, and is one-fifth of the total length (without caudal); the length of the head is one-fourth of the same. The snout is slightly produced, rather obtuse, and about half the length of the postorbital portion of the head. The length of the maxillary bone exceeds that of the snout by three-fourths of the diameter of the eye, its greatest width being half the same. The lower jaw is straight, without hook, and the mouth closes perfectly.

The dentition is perfect; the teeth of the maxillary bones are smaller than those of the intermaxillary, palatines, and mandible. The teeth on the vomer are disposed in an almost completely double series. The interorbital space is rather flattened, the eye being placed very slightly below the upper profile of the head; the width of this space is one-half the length of the postorbital portion of the head, and more than two-thirds of that of the maxillary bone. The maxillary bone extends slightly beyond the vertical from the posterior margin of the eye.

The hinder margin of the præoperculum is slightly convex, the lower one not very distinct. The hinder margin of the operculum is almost straight, very oblique, and forms a right angle with the lower limb. The distance from the upper end of the gill-opening to the opercular angle is equal to that from the latter point to the lower anterior end of the suboperculum. Suboperculum rather more than twice as long as high.

The distance of the dorsal fin from the occiput, if measured back from behind that fin, reaches to midway between the adipose and the root of the caudal. The length of the dorsal fin is nearly equal to its height. It consists of fourteen rays, the first three of which are rudimentary and covered by skin, the fourth simple and much shorter than the next, which is branched; the last ray cleft to the root.

The ana fin is higher than long, and composed of eleven rays, the first three being covered by skin, the fourth simple and not much shorter than the fifth; the last ray cleft throughout. The pectoral fin is a quarter of an inch longer than the postorbital portion of the head, reaching about half of the distance of its root from the ventral. The ventral fin is shorter; its length is more than half of the distance of its root from the vent: its outermost ray is vertically opposite to the tenth of the dorsal fin. Caudal truncated.

There are 117 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backward

from the origin of the dorsal fin to the lateral line has twenty-eight scales; that from the hinder end of the adipose forwards to the lateral line has fifteen scales; there are twenty-one longitudinal series between the lateral line and the root of the ventral. Scales rounded, without median ridge.

Coloration the same as in the male specimen.

Pyloric appendages forty-one.

B. *Species with a limited geographical range.*

I. *Algeria.*

5. Salmo macrostigma.

Salar macrostigma, *Duméril, Rev. et Mag. Zool.* 1858, no. 9. pl. 10.
Salmo lapasseti, *Zill, Ann. Sci. Nat.* 1858, i. p. 126.

D. 13–14. A. 11. V. 9. P. 13. L. lat. 122. L. transv. 27/34. Cæc. pyl. 28–31. Vert. 57.

This Trout is very closely allied to *S. fario*, and distinguished by the small number of pyloric appendages. It has a somewhat less broad and strong maxillary bone, not extending beyond the vertical from the hind margin of the orbit in specimens 6 or 7 inches long; a short præoperculum with scarcely any lower limb; and the vomerine teeth arranged in a zigzag series. The length of the pectoral is more than one-half of the distance between its root and that of the ventral, the trunk being comparatively short. Body with ocellated spots, the Parr-marks being still very distinct in specimens of the size indicated, which do not appear to be adult*. Dorsal and anal fins with a black and white anterior margin.

This is the southernmost species of the Salmonoids of the Old World; it resembles much the young state of the more developed northern species *S. fario*. From the Oued-el-Abaïch, Algeria.

a–c. From 6 to 7 inches long. Algeria. Presented by Dr. Schimper.

Description of a Female specimen seven inches long; ovaries developed; ova minute.

The greatest depth of the body is below the origin of the dorsal fin, equal to the length of the head, and one-fourth of the total length (caudal not included). Snout short, obtuse, but more than half the length of the postorbital portion of the head.

The length of the maxillary bone is somewhat less than that of the snout together with the diameter of the eye, its greatest width being two-fifths of the latter. Teeth of moderate strength; those of the vomer are arranged in a zigzag series, but the points are so much bent towards the right and left as to give the appearance of a double series. The interorbital space is flat, with a slight median ridge, the eye being placed somewhat below the upper profile; the

* M. Duméril considers these Parr-marks a specific character; they are common to all Salmonoids of a certain age.

width of this space is more than one-half of the length of the post-orbital part of the head.

The posterior margin of the præoperculum is slightly convex, the lower limb being very indistinct; the posterior margin of the operculum is straight, and forms a right angle with the lower. A line from the upper end of the gill-opening to the angle of the operculum equals a line from that point to the lower anterior end of the suboperculum. The suboperculum is twice as long as broad.

The distance of the dorsal fin from the occiput, if measured back from behind that fin, reaches nearly to the root of the caudal fin. The dorsal fin is a little higher than long, and consists of fourteen rays, the first three being rudimentary, the fourth simple, and the fifth and sixth branched and the longest of the fin.

The anal fin is two-thirds as long as high, and consists of eleven rays, the first two being rudimentary, the third simple, the fourth the first branched ray, and the fifth the longest of the fin.

The pectoral fin is somewhat shorter than the length of the head (without snout), and longer than one-half of its distance from the ventral. The ventral fin is much shorter, and reaches two-thirds of the distance from its root to the vent; its outermost ray is in the vertical from the ninth of the dorsal; appendage in its axil very short. Caudal fin somewhat emarginate, its middle rays being two-thirds the length of the outer ones*.

There are 122 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to the lateral line has twenty-seven scales; that from the hinder end of the adipose forwards to the lateral line has fifteen scales; there are twenty-four longitudinal series between the lateral line and the root of the ventral. Scales rounded, thin.

II. *Pyrenean Peninsula.*

The Salmonoids of the Pyrenean peninsula have not yet been properly examined or described. *Cornide* (Ensayo de una historia de los peces de la costa de Galicia, 1788, 16mo) appears to be the only author who has written about them; but his account does not contain anything by which the different species might be characterized. Besides the Salmon which we have mentioned above, he mentions—

1. The *Lirio*, very similar to the Salmon from the river Tambre (p. 81).

2. The *Reo*, a migratory Trout, representing *S. trutta* or *S. cambricus*, common in all the rivers of Galicia (p. 82).

3. The *Trucha*, a River-Trout, generally known in the whole of Spain (p. 84).

III. *Asia Minor.*

Our evidence of a species of *Salmo* inhabiting Asia Minor is based upon young specimens obtained on the summit of Mount Olympus. They are evidently the young of a non-migratory Trout with a double

* This fin is more deeply emarginate in examples less advanced in their sexual development than the specimen described.

series of teeth on the vomer, and have been mentioned before by Sir J. Richardson, Proc. Zool. Soc. 1856, p. 372.

a, *b–c*. Young. Mount Olympus. Presented by H. Poole, Esq.

IV. *Italy and rivers falling into the Adriatic.*

6. Salmo dentex.

The Great Dalmatian Trout. Pastrova.

Salar dentex, *Heckel, in Sitzgsber. Akad. Wiss. Wien*, 1864, viii. p. 371, taf. 10; *Heck. & Kner, Süsswasserf.* p. 256, fig. 142.

D. 12–13. A. 12. P. 13. V. 9. L. lat. 118–126. L. transv. 24/35.

Head of moderate size when compared with the body, rather low. The posterior point of junction of operculum and suboperculum is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum with the lower limb very indistinct, subcrescentic. Snout more or less produced, according to age and sex. Maxillary as broad and strong as in *S. fario*; in old individuals it is extremely strong and solid, and bent downwards; it extends to below the hind margin of the orbit in specimens 12 inches long, and much beyond it in old ones. Teeth strong, especially those of the intermaxillary; vomerine teeth in a double longitudinal series, persistent through life. Fins moderately developed; the caudal fin is very slightly emarginate in specimens 12 inches long, and becomes convex in old examples. There are thirteen or fourteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.

Brownish (darker or lighter), silvery towards the sides, and brown on the belly; body with very numerous and very small irregular black dots; head with numerous round spots and undulated markings; red spots are intermixed between the black ones. Base of the dorsal with black spots.

A non-migratory species from the rivers of Dalmatia.

a. Forty inches long: skin. River Narenta. Presented by L. Conyngham, Esq.

b. Forty-four inches long: stuffed. River Narenta. Presented by L. Conyngham, Esq.

This species appears to be nearly allied to *S. lemanus* and to *S. ferox*, unless a more detailed examination reveals other more important differences. Perhaps no other European Salmonoid has the jaws so powerfully developed as this species; the character of the large intermaxillary teeth, from which the name "dentex" was derived, is not so prominent in old age as in young.

7. Salmo genivittatus.

Salar genivittatus, *Heck. & Kner, Süsswasserf.* p. 260, fig. 144.

D. 11. L. lat. 120. L. transv. 20/2.

Known from a single example only, 18 inches long.

Head of moderate size, eye small, its diameter being one-half of

the length of the snout, and one-fifth of its distance from the end of the operculum. Maxillary strong, broad, extending far behind the eye. Teeth strong; vomerine teeth in a single series anteriorly, and in a double one posteriorly. Præoperculum rounded. The distance between the end of the snout and the occiput is one-half of that between occiput and origin of dorsal fin, the origin of the dorsal fin being midway between snout and end of adipose fin. The free portion of the tail is long and slender. Fins moderately developed; caudal subtruncated. Sides of the head with large, oblong, blackish-brown spots, some confluent into bands. Body and fins immaculate. (*H. & K.*)

River Sala, a tributary of the Isonzo.

8. Salmo obtusirostris.

River-Trout of Dalmatia (and of Italy). Trotta.

Trotta, *Salviani*, fol. 97, c. fig. fol. 96, cop. by Willughby, tab. N. 3.

? Salmo marmoratus, *Cuv. Règne Anim.*

Salar obtusirostris, *Heckel, in Sitzgsber. Akad. Wiss. Wien*, 1852, viii. p. 367, taf. 9; *Heck. & Kner, Süsswasserf.* p. 253, fig. 139.

D. 14. A. 11–12. P. 13. V. 9. L. lat. 101–103. L. transv. 20/21.

Head rather short, with the snout very convex and obtuse, body stout. Præoperculum with the lower limb distinct. Maxillary very broad and short, in specimens 15 inches long not extending to the hind margin of the eye. Dentition rather feeble: the vomerine teeth form a double series, and are persistent throughout life. The length of the pectoral is more than one-half of its distance from the ventral; caudal slightly emarginate in specimens of the length indicated. Coloration similar to that of *S. fario*. (*Heckel.*)

A non-migratory species from the Dalmatian rivers, and the Tiber; rarely much exceeding a foot in length.

V. *The Alpine region of Central Europe.*

The great lakes of the Alpine region of Central Europe are inhabited by Trout which do not descend to the sea, but sojourn in those fresh waters after having ascended their affluents and deposited their spawn. Their specific distinction has been a matter of great difficulty; and previous authors have evidently frequently confounded the species, attributing characters to one originally taken from another. Heckel, Kner, and Rapp had prepared the way to a better understanding of these fishes, when Siebold finding that a number of individuals are not sexually developed, and that this condition of the sexual organs is accompanied by certain external peculiarities, expressed it as his opinion that all these fishes were of but a single species. However, when we consider that, if this were true, the number of the pyloric appendages must be assumed to *vary* from 40 to 100, that of the vertebræ from 57 to 61, that the form of the præoperculum also must be subject to extraordinary *variation*, we hesitate before we adopt so bold an opinion. Variation to such a degree is not confirmed by the examination of Salmonoids of other countries,

nor is it found among individuals of Alpine Lake-Trout from the same locality*. As regards the sterility of these fishes, Siebold has evidently gone too far in regarding really distinctive characters as peculiarities dependent on the condition of the sexual organs. We shall see subsequently that females of a species declared by Siebold to be merely a sterile form, are sexually fully developed (p. 84); and on the other hand that a female of a species regarded by him as the sexually developed form, is sterile (p. 82); besides, Widegren has shown that sterility is not always permanent, but generally a temporary immaturity. According to the present state of our knowledge, we believe the following species may be considered to be well established:—

1. *S. carpio* from the Lake of Garda. Vomerine teeth in a single series, all pointing backwards. Cæc. pyl. 40–50.
2. *S. lemanus* from the Lake of Geneva. Head and body covered with very small spots. Vert. (57) 58–59. Cæc. pyl. 45–52.
3. *S. rappii* from the Lake of Constance. Body stout; caudal truncate. Vert. 59–60. Cæc. pyl. 48–54.
4. *S. lacustris* from the lake of Constance and other lakes of Upper Austria. Body slender; caudal more or less emarginate. Vert. 60–61. Cæc. pyl. 60–74.
5. *S. marsilii* from the lakes of Upper Austria. Body stout; maxillary narrow. Vert. ? Cæc. pyl. 90–100.

9. Salmo carpio.

The Trout of the Lake of Garda. Carpione.
Carpione, *Salvian.* fol. 99. pl. 25 (fig. bona).
Carpio, *Bellon.* p. 276; *Rondel.* ii. p. 158 (fig. mala); *Gesner*, p. 184; *Aldrov.* p. 655 (fig. copied on p. 653 as Trutta Benaci lacus); *Willughby*, p. 197.
Salmo, *Artedi, Synon.* p. 24. no. 4; and *Gen.* p. 13. no. 7.
Salmo carpio, *L. Syst. Nat.* i. p. 510 (part.).
? Salmo punctatus, *Cuv. Règne Anim.*
Fario carpio, *Heckel, in Sitzgsber. Akad. Wiss. Wien*, 1852, viii. p. 361. taf. 10. figs. 9, 10 (vomerine teeth); *Kner, ibid.* p. 215 (pylor. append.).

D. 13. A. 12. L. lat. 123. Cæc. pyl. between 40 & 50.

Snout of moderate length; in specimens fourteen inches long the maxillary extends to the vertical from the hind margin of the orbit. The vomerine teeth (about sixteen in number) form a single series, and are not alternately bent towards the right and left, but the points of all form a straight line, all being equally curved backwards. Cau-

* Heckel and Kner refer the Trout from the Lake of Constance, described by Rapp as *S. trutta*, to their *Fario marsiglii* from the Upper Austrian lakes, and express their surprise that Rapp counted forty-eight pyloric appendages only, whilst they always found more than eighty. In a foot-note (p. 270) they even insinuate that Rapp took his statement from specimens of the *S. lemanus*. Against this I may observe that I myself witnessed Rapp's examinations of these fishes and that the pyloric appendages were most carefully and repeatedly counted in several specimens obtained directly from the Lake of Constance; moreover each of the three examples in the British Museum has exactly fifty-four cæca.

dal fin distinctly emarginate. Silvery, with a few scattered small black spots on the trunk, those on the head being larger and more numerous; fins immaculate.

This is a non-migratory species from the Lago di Garda; and although it was known in the sixteenth century, the knowledge of its characters and habits is very incomplete, Heckel being the only recent naturalist who has given an account of some specimens in the Vienna Museum.

10. Salmo lemanus.

The Trout of the Lake of Geneva.
Umbla altera, *Rondelet.* ii. p. 160.
Salmo lemanus, *Cuv. Règne Anim.*
La truite, *Jurine, in Mém. Soc. Phys. et Hist. Nat. Genève,* iii. 1. 1825, p. 158, pl. 4.
Salmo trutta, *Agass. Poiss. d'eau douce,* pl. 8 (female).
Fario lemanus, *Cuv. & Val.* xxi. p. 300, pl. 617 (male).

D. 13. A. 12. P. 14. V. 9. L. lat. 115–128. L. transv. 26–28/36. Cæc. pyl. 45–52. Vert. 57 (once), 58–59.

Head well proportioned in its shape, of moderate size; body rather stout. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum with a distinct lower limb; operculum rather broad and high. Snout of moderate length, rather produced in the male sex, in which a mandibular hook is developed in the spawning-season. Maxillary longer than the snout, and at least as strong and broad as in *S. fario*; in specimens twelve inches long it extends somewhat behind the vertical from the hind margin of the orbit. Teeth moderately strong; those on the vomer in a single series, alternately bent towards the right and left, persistent throughout life. Pectoral fin rounded, its length being less, and in young individuals more than, one-half of its distance from the ventral. The caudal becomes truncate with age; in specimens of from 12 to 15 inches in length, it is emarginate, the middle rays being half as long as the outer ones. The hind part of the body of moderate depth; there are thirteen or fourteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.

Back greenish, sides and belly silvery, numerous very small X-shaped black spots on the sides. Opercles and dorsal fin with numerous black dots. The other fins greenish.

A non-migratory species from the Lake of Geneva and Lago Maggiore.

a–h. From 7–15 inches long. Lake of Geneva. Presented by the Museum of Natural History of Geneva.—None of these specimens are sexually developed: they were caught in the month of August.

i. Female, sexual organs not developed: 12 inches long. From Prof. Agassiz's Collection.

k. Skin, 10 inches long. Lago Maggiore. Presented by T. C. Eyton, Esq.

Agassiz and Siebold confound this species with the *Salmo lacustris* from the Lake of Constance, which has a different number of vertebræ and pyloric appendages. *S. lemanus* is more nearly allied to *S. fario* and *S. rappii* than to *S. lacustris*. The figures given by Agassiz and by Valenciennes convey a very good idea of the characters of this fish.

11. Salmo rappii.

Grund-Forelle of the Lake of Constance.
Sefährin, etc., *Mangolt, Fischbuch*, p. 15.
Salmo illanea, *Wartmann, Schrift. Berl. Gesellsch. ntrf. Freund.* iv. 1783, p. 55; cop. by *Bloch*, iii. p. 180 (*S. lacustris*).
—— trutta, *Schrank, Nhrhist. Briefe*, i. p. 312, and *Faun. boica*, i. p. 319; *Hartmann, Beschreib. Bodensee's*, pp. 146, 147.
—— lacustris, *Hartmann, Helvet. Ichthyol.* p. 101.
Salmo trutta, *Agass. Poiss. d'eau douce*, pl. 6, 7, 7*.
Fario trutta, *Rapp, Fische des Bodensee's*, p. 29, taf. 4 (fig. optima).
Trutta lacustris, part., *Siebold, Süsswasserfische*, p. 301.

B. 11. D. 13. A. 12. P. 13. V. 10. L. lat. 120. L. transv. 27/35. Cæc. pyl. 48–54. Vert. 59–60.

Attaining to a length of 36 inches.

Head somewhat depressed, proportionate in size, nearly two-ninths of the total length (without caudal); body stout. Præoperculum crescent-shaped, with a very distinct lower limb; posterior opercular margin obtusely rounded, the operculum being short. Snout produced in very large males only, generally rather obtuse; male with a short mandibulary hook. Maxillary strong, dilated in its hinder portion, extending beyond the orbit in adult examples. Teeth strong; vomerine teeth in a single series, but frequently irregularly placed, persistent throughout life. Fins well developed; caudal truncate in mature examples. There are about sixteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.

Sides with a reddish hue, and with numerous X-shaped brownish spots. Opercles with roundish spots.

Lake of Constance.

a. Male, 24 inches long. Presented by Professor W. von Rapp. Obtained in the month of December, after spawning; mandibulary hook slightly developed. Cæc. pyl. 54.
b. Female, 17 inches long. Presented by Prof. W. von Rapp. Obtained at the same time; ovaries not developed, ova minute. Cæc. pyl. 54.
c. Male, 32 inches long: skeleton. Presented by Prof. W. von Rapp. Obtained with the former specimens; mandibulary hook well developed.
d. Intestines of specimen *c*. Cæc. pyl. 54.

12. Salmo lacustris.

The Schweb-Forelle of the Lake of Constance.

We retain the specific denomination of "*lacustris*" for this species, although neither Artedi nor Linné had an exact knowledge of it, evidently confounding different fishes, one of which is the lacustrine species of Swiss lakes mentioned by Gesner and Willughby.

Trutta magna vel lacustris, *Gesner*, p. 1200 (fig. et pars descript.).
Trutta seu Fario lacustris, *Gesner*, p. 1210 (part.).
Schwäbförine, *Gesner*, p. 1203.
Trutta lacustris, *Will.* p. 198 (synon. part., fig. copied from Gesner).
Salmo no. 9, *Artedi, Synon.* p. 25; and no. 4, *Gen.* p. 12. Diagnosis copied from Willughby. ("Sulco longitudinali in ventre" is a character which may be seen in many specimens of all Salmonoids some time after death).
Salmo lacustris, *L. Syst. Nat.* i. p. 510.
Salmo schiffermülleri, *Bloch, Fische Deutschl.* iii. p. 157, taf. 103.
Maiferche, *Schrank, Naturalist. Briefe*, i. p. 4.
Silberlachs (S. schiffermülleri), *Schrank, Faun. boica*, i. p. 323.
Schweeb-Forelle, *Hartm. Beschreib. Bodensee's*, p. 147.
See-Forelle, *Hartm. Helvet. Ichthyol.* p. 111.
? Salmo trutta, *Meidinger, Icones*, tab. 21.
Salmo lacustris, *Agass. Poiss. d'eau douce*, pls. 14, 15, 15ª.
Salar schiffermülleri, *Cuv. & Val.* xxi. p. 344; *Heckel, in Sitzgsber. Acad. Wiss. Wien.* 1852, viii. pl. 7. figs. 1–3; *Kner, ibid.* 1851, vi. p. 244, and 1852, viii. p. 210; *Heck. & Kner, Süsswasserfische*, p. 261, fig. 145.
Mai-Forelle, *Heckel, in Sitzgsber. Acad. Wiss. Wien.* 1852, viii. p. 349.
Fario lacustris, *Rapp, Fische des Bodensee's*, p. 27, tab. 3 (fig. optima).
Salar lacustris, *Heck. & Kner, Süsswasserfische*, p. 265, fig. 147.
Trutta lacustris (sterile), *Siebold, Süsswasserfische*, p. 302.

D. 13. A. 11. P. 13. V. 9. L. lat. 120. L. trans. 26/30. Cæc. pyl. 60–74. Vert. 60–61.

Largest specimen observed 30 inches; female mature at a length of 18 inches.

Head compressed, low, rather small when compared with the body; body slender. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum, than to the upper end of the gill-opening. Lower limb of the præoperculum rather distinct, forming a very obtuse angle with the hinder one. Snout produced, conical; male with an obtuse and short mandibulary hook. Maxillary much longer than the snout, strong and dilated in its hinder portion; in specimens 14 inches long it extends to below the hinder margin of the orbit, and beyond the latter in larger examples. Teeth strong; the head of the vomer is triangular, broader than long; the teeth of the body of the vomer form a single or sometimes a zigzag series, and are persistent throughout life. Fins well developed; the pectoral is pointed, its length being one-half, or more than one-half, of the distance of its root from that of the ventral. Caudal always with the lobes angular, emarginate, appearing truncate in old examples only when stretched to the utmost extent; in specimens 18 inches long the middle caudal

rays are nearly half as long as the outer ones. There are fifteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.

Bright silvery, greenish on the back; more or less numerous X-shaped black spots on the sides; smallish round spots on the gill-covers and the dorsal fin; the other fins blackish towards the extremity.

Lake of Constance and lakes of Upper Austria.

a. Fine female specimen, 18 inches long. Lake of Constance. From the Stuttgart Museum. Ovaries and ova fully developed*.

b–c. Fine sterile specimens, 23 to 18 inches long. Lake of Constance. Presented by Prof. W. von Rapp.

d. Fine sterile specimen, 19 inches long. Lake of Constance. From the Stuttgart Museum.

e. Sterile female specimen, 14 inches long. Lake of Constance. Presented by Prof. v. Siebold.

f. Skeleton. Lake of Constance. From Dr. A. Günther's Collection.

13. Salmo marsilii.

Lax, *Marsil. Danub. Pannon.-Mys.* iv. p. 10, tab. 22.
Lachs-Forelle, *Heckel, in Sitzgsber. Acad. Wiss. Wien*, 1852, viii. p. 348.
Fario marsiglii, *Heckel, l. c.* taf. 7. figs. 6–8; *Kner, ibid.* 1851, vi. p. 244, and 1852, viii. p. 215; *Heckel & Kner, Süsswasserfische*, p. 267, fig. 149 (not good).
Trutta lacustris, part., *Siebold, Süsswasserfische*, p. 301.

B. 10–11. D. 13. A. 11. L. lat. 120. Cæc. pyl. 90–100.

Attaining to a length of 36 inches and more. Head of proportionate size; body stout. Præoperculum crescent-shaped, with a very indistinct lower limb; posterior opercular margin rather angular; the posterior point of junction of operculum and suboperculum is midway between the lower anterior angle of the suboperculum and the upper end of the gill-opening. Snout moderately produced; maxillary rather narrow, moderately dilated behind, extending to behind the orbit in adult examples. Teeth strong; vomerine teeth in a single series, alternately bent towards the right and left, and frequently somewhat irregularly placed. Fins well developed; caudal subtruncate or slightly emarginate in adult examples.

Sides with numerous brownish spots, roundish on the opercles and on the trunk, more X-shaped towards the tail.

Mountain-lakes of Upper Austria.

* Prof. v. Rapp informs me, that he also has found the abdominal cavity full of ova as large as hemp-seed, in a specimen weighing four pounds and obtained in December.

VI. *Hungary.*

14. Salmo microlepis.

? Trutta fluviatilis, *Marsil. Danub. Pann.-Mys. Pisc.* p. 77, tab. 26. fig. 1.

D. 13–14. A. 11. P. 14. V. 9. L. lat. 135–140. L. trans. 29/30. Cæc. pyl. 72. Vert. 60–61.

Although we have only young specimens of this species, its characters are so well marked that no doubt can be entertained of its being distinct from the other European non-migratory species. In comparing specimens with the following diagnosis, the size of the examples from which it is taken must be borne in mind.

Attaining to a length of — ? inches; female mature at a length of 8 inches.

Head rather short, body somewhat slender. The posterior point of junction of operculum and suboperculum is midway between the lower anterior angle of the suboperculum and the upper end of the gill-opening. Lower limb of the præoperculum distinct, forming an obtuse angle with the hinder one. Snout short: maxillary stout and broad; in specimens 8½ inches long it does not extend to the vertical from the hind margin of the eye. Teeth moderately strong, those of the vomer in a zigzag line, rarely two side by side. Pectoral fin rather obtuse, its length being more than one-half of the distance of its root from that of the ventral fin. Caudal fin emarginate, the length of its middle rays being contained once and three quarters in that of the outer ones. There are fifteen or sixteen scales in an oblique series, descending from behind the adipose fin backwards to the lateral line.

Greenish or brownish, shining silvery, with round, sometimes reticulated black spots on the sides; more or less numerous red or orange-coloured spots are scattered between them. One of the specimens shows *twelve* Parr-marks; none of the fins have a yellow or black margin.

A non-migratory species from Hungary.

a. Eight inches and two-thirds long: female, with distinct ovaries. Hungary. From Hr. Jeitteles's Collection.

b. Eight inches and a half long: male, with the testicles fully developed. Pohorella. From Hr. Jeitteles's Collection.

c. Seven inches and three quarters long: female, with the ova nearly fully developed. Hungary. From Hr. Jeitteles's Collection.

Heckel and Kner (Süsswasserf. p. 258) describe a non-migratory Trout from Teschen (Austrian Silesia) under the name of *Salar spectabilis*. The vicinity of the habitat of this species to that of *S. microlepis* induced me to compare these fishes; but I have not been able to find evidence of their specific identity. The original description of *S. spectabilis*, given by Valenciennes, does not agree with our specimens, nor can I understand, from a comparison of Valenciennes's and Heckel's descriptions, the reason why the latter has identified the Teschen Trout with *S. spectabilis*. Nothing is mentioned of a comparison of specimens of both species having taken

place; and the two would appear to agree in one point only, viz. that the scales are more conspicuous than usual! As regards the question whether *S. spectabilis* (Heckel) might possibly be identical with *S. microlepis*, I do not think that we should be justified in entertaining this idea, as *S. microlepis* has small and rather inconspicuous scales, which must be larger in *S. spectabilis* (Heckel), viz. "120 and more." The figure representing *S. spectabilis* is of little use; it does not agree with the description, and shows several evident inaccuracies.

VII. *France.*

15. Salmo argenteus.

Fario argenteus, *Cuv. & Val.* xxi. p. 294, pl. 616 (female), (not synon.).

B. 11. D. 14. A. 11. P. 15. V. 10. L. lat. 123. L. transv. 26/30. Cæc. pyl. 61–67.

Attaining to a length of 2½ feet.

Head elongate, broad, depressed, its length being one-fourth of the tota llength (without caudal) in a female specimen 26 inches long; operculum rather long, rectangular behind, its length being contained once and two-fifths in its depth; radiating striæ are conspicuous especially along its lower margin; the suboperculum is narrow, and projects beyond the opercle. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum with the lower limb well developed, with the angle but slightly rounded, and with the hind margin undulated. Snout broad, of moderate length; jaw-bones strongly developed, even in females. The maxillary is broad and strong, and extends to behind the orbit in a female of the size indicated. Teeth of moderate strength. Head of the vomer broader than long, with a transverse series of five or six strong teeth on its hind margin; body of this bone with a longitudinal ridge, armed with a single series of teeth (there are three or four teeth in the specimen described).

Fins well developed; caudal truncate in specimens above 20 inches in length. Tail rather slender, covered with thin scales angular behind and not smaller than those of the body; there are twelve or thirteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.

Silvery, dark on the back; opercles with more or less numerous round black spots; sides with X-shaped spots.

A migratory species of the Atlantic rivers of France; occasionally on the coast of England.

a. Female, 26 inches long. River Rhymney, Monmouthshire. Presented by the Rev. Augustus Morgan. (Has been kept for a short time in a freshwater pond.)

16. Salmo bailloni.

Salar bailloni, *Cuv. & Val.* xxi. p. 342.

B. 9. D. 13. A. 10. C. 23. P. 12. V. 9.

Vomerine teeth in a double series. The length of the head is comprised four times and a half in the total length. Forehead broad; the two jaws equal; snout rather pointed; teeth fine and closely set on the jaws, the palatines, and the vomer; these last, in two series, are much smaller than any of those in our common Trout. The back is leaden-coloured, with violet reflections, and covered with rather large, purplish spots. There are some small brown spots on the dorsal. The pectorals and anal are yellowish. The ventral is white. The caudal, somewhat forked, is grey, without spots. The entire fish is shining silvery. (Valenc.)

The specimens were caught in the Somme, and are believed to be of a migratory species coming from more northern seas. It ought to be compared with *Salmo cambricus*; the description is so insufficient that, without reexamination of the typical specimens, no opinion can be given as to their affinities.

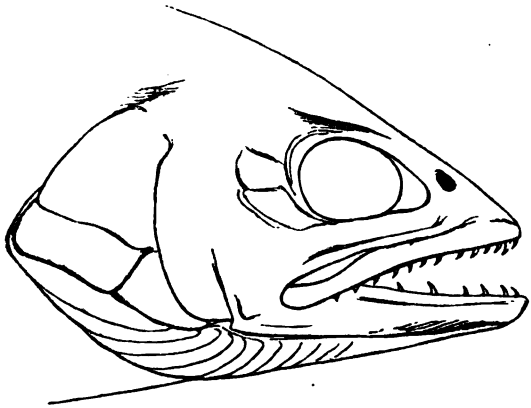
VIII. *Great Britain and Ireland.*

17. Salmo brachypoma.

Salmo eriox, *Parnell, Fish. Firth of Forth*, p. 128, descript. pars, and pl. 32. fig. 3 (bad).

D. 13. A. 10–11. P. 14. V. 9. L. lat. 118–128. L. transv. 27/30 Cæc. pyl. 45–47. Vert. 59.

Head comparatively small, its length being contained four times and two-thirds in the total (without caudal), four times in old males. Body rather more elongate than in *S. fario*. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-



S. brachypoma, specimen *d*, nat. size.

S. brachypoma.
Præoperculum of specimen *a*, reduced.

opening. The præoperculum is so short in the longitudinal axis of the body that it has scarcely a trace of a lower limb. Snout moderately produced in old males, very short and obtuse in young specimens; the lower jaw with a distinct hook in old males. Maxillary longer than the snout, narrower and less strong than in *S. fario*; in specimens 14 inches long it extends nearly to the vertical from the hind margin of the orbit, and at no age does it reach much beyond it. Teeth rather strong: those of the vomer disposed in a double series, but in a zigzag line; most of them are lost in specimens 17 inches long, only a few of the anterior remaining. Fins small, short, and rounded, the length of the pectoral of mature examples being less than one-half of its distance from the ventral. The caudal fin is truncate in specimens 10 inches long, but does not become convex at any age. The hind part of the body is of moderate depth; there are about fifteen scales in a transverse series descending from behind the adipose fin to the lateral line.

Sides of the body with more or less numerous X-shaped or ocellated black spots, some red spots along and below the lateral line; dorsal with round black spots. Dorsal, anal, and ventral fins with a white and black outer margin in young examples.

A migratory species from the rivers Forth, Tweed, and Ouse.

a. Male, stuffed: 30 inches long. Firth of Forth. From Mr. Parnell's Collection.

b. Male, skin, type of the figure, pl. 32. fig. 3: 13½ inches long. River Tweed. From Mr. Parnell's Collection.

c–d. Skins, 8 and 10 inches long. Tributary of Forth. From Mr. Parnell's Collection.

e. Skin, 27½ inches long. Great Britain. From Mr. Yarrell's Collection.

f–g. Male and female, 17 and 18 inches long. River Ouse. Presented by J. H. Phillips, Esq. Caught Sept. 18th.

This is one of the best-marked species of *Salmo*; its remarkably short head, and the extremely short præoperculum render it one of the easiest of determination. It is evidently nearly allied to the non-migratory species. Parnell named three of our specimens *S. fario*, and a larger one *S. eriox*.

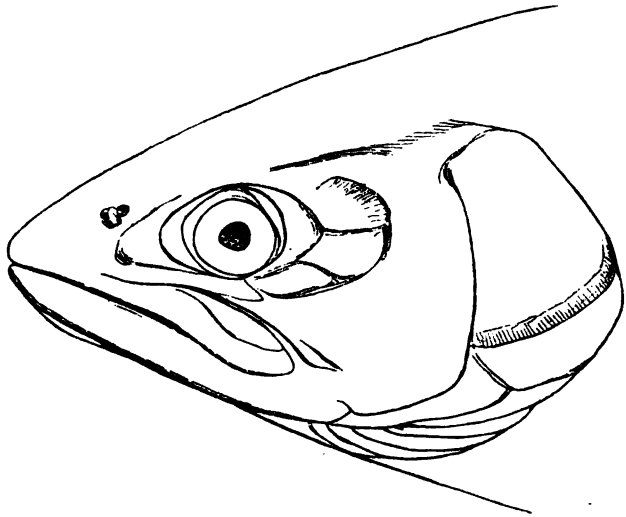
18. Salmo gallivensis.

Galway Sea-Trout.

B. 11. D. 13. A. 11–12. P. 15. V. 9. L. lat. 125.
L. trans. 25/38. Vert. 59. Cæc. pyl. 44.

Head rather small, very convex above, with the snout of moderate length, but terminating in an acute point. Eyes rather small. Operculum of moderate width and depth; suboperculum narrow; præoperculum with a distinct lower limb. The posterior point of junction of operculum and suboperculum is much nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Maxillary very narrow and feeble, extending a little beyond the hind margin of the orbit in females 18 inches long, and

nearly to the hind margin in young examples 7 or 8 inches long. Dentition feeble: the vomerine teeth form a single series, and most of them appear to be persistent to mature age; they are alternately bent towards the right and left in young examples: teeth on the tongue very small. Fins moderately developed; pectoral somewhat pointed: caudal fin truncate in mature examples, with the angles pointed; forked in young specimens, in which the length of the middle rays is two-fifths of that of the outer ones. Tail not elongate, covered with rounded scales, which are a little larger than those of the trunk. There are fourteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.



S. gallivensis, specimen *b*, $\frac{4}{5}$ths nat. size.

Young, with about nine Parr-marks, with ocellated black and red spots, and with white borders to the anal, dorsal, and ventral fins as in *S. fario*. Mature females, caught in August, very dark-coloured, with silvery lustre on the lower parts only; sides with rather numerous black X-shaped spots; opercles with black spots. Fins black: dorsal with a few small, obscure spots; caudal with an indistinct black posterior margin.

A migratory species from Galway, well characterized by the acutely pointed, but not elongate snout, broad, convex head, small eye, feeble teeth, feeble maxillary and mandible, and by extremely thin and short pyloric appendages, the longest of which is 1 inch long, and not thicker than the quill of a pigeon. We received at the same time and from the same locality, through the kindness of Mr. Godman, some young individuals; but the greater part of them appear to be hybrids, probably between this species and *S. gaimardi*.

a–b. Fine female specimens, 18 inches long. Ballinahinch Fishery. Presented by F. Godman, Esq.—Caught in August; ovaries with the ova fixed and developed to the size of hemp-seed.

c–d. Seven and eight inches long. Ballinahinch Fishery. Presented by F. Godman, Esq.

e–h. ? Hybrids with *S. gaimardi*, from 6 to 10 inches long. Ballinahinch Fishery. Presented by F. Godman, Esq.

Description of specimen a.

The greatest depth of the body is below the origin of the dorsal fin, and scarcely exceeds the length of the head, which is contained four times and a third in the total length (without caudal).

The snout is produced, conical, compressed towards its point, its length being contained once and three-fourths in the length of the postorbital portion of the head. The maxillary bone is longer than the snout by three-fifths of the diameter of the eye, and extends a little beyond the posterior margin of the orbit: the width of its broadest part is scarcely more than one-half of the diameter of the eye *.

The teeth of the mandible are larger than those in the upper jaw; those of the intermaxillary bone are about equal to those of the palatine series, and are larger than those of the maxillaries. Of the vomerine teeth only three or four remain; they are placed in a single longitudinal series, and are very small. Also the lingual teeth are small not larger than those of the mandible.

The interorbital space is very convex, the eye being situated considerably below the upper profile of the head; the width of this space is one-eighth of an inch shorter than the maxillary bone, and ebual to about three-fifths of the postorbital portion of the head.

The posterior margin of the præoperculum is slightly rounded and subvertical; the lower limb is distinct. The hinder margin of the operculum meets the lower at a right angle. The distance from the upper end of the gill-opening to the angle of the operculum is conspicuously more than that from the latter point to the lower anterior angle of the suboperculum.

The distance of the occiput from the origin of the dorsal fin, if measured back from behind that fin, reaches nearly to the middle of the distance between the adipose and the root of the caudal. The dorsal fin is a little higher than long, and possesses thirteen rays, of which the first and second are rudimentary, and covered by the skin, the third simple and shorter than the following one, which is the first branched and, with the fifth, the longest in the fin; the final ray is cleft throughout.

The anal fin is much higher than long, and possesses eleven rays, of which the first and second are rudimentary and covered by the skin, the third simple, the fourth branched and the longest, and the last ray cleft to its root.

* If the width of the bone itself is taken; whilst it appears broader when covered by the skin, as in the figure.

Pectoral as long as the head without snout, reaching to the middle of the distance of its root from that of the ventral. Ventral much shorter, equal to one-half of the distance of its root from the anal; its outermost ray is vertically opposite the ninth of the dorsal. Posterior margin of the caudal fin truncate.

There are 125 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to that line has twenty-five scales; that forwards from the hinder end of the adipose has fourteen scales. There are twenty-two longitudinal series between the lateral line and the root of the ventral. The scales are very thin, with the hinder margin irregularly rounded.

Blackish above and on the sides, each scale with a silvery lustre on its hind margin. Lower parts silvery. Sides with numerous black X-shaped spots; opercles with round black spots. Fins as described above.

19. Salmo orcadensis.

D. 13. A. 11. P. 14. V. 9. L. lat. 115. L. transv. 25/30.
Cæc. pyl. 50. Vert. 56–57.

This species is very similar to *S. nigripinnis*, but distinguished from it by a broader and stronger maxillary, larger scales on the tail, and a greater number of pyloric appendages.

Head well proportioned in its shape, and rather short when compared with the body; body rather slender. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum with the lower limb very indistinct. Snout short, conical. Maxillary as broad and strong as in *S. fario*; in specimens 9 inches long it does not extend to below the posterior margin of the orbit. Teeth moderately strong; those of the vomer form a single series, and are persistent. Fins well developed; pectoral somewhat rounded, its length being more than one-half of its distance from the ventral. The caudal fin is distinctly emarginate in specimens 9 inches long, but nearly perfectly truncate in specimens 12 inches in length; it has the lobes pointed. Scales on the hinder half of the tail considerably larger than on the sides of the trunk; there are about thirteen in a transverse series descending from behind the adipose fin obliquely forwards to the lateral line.

Sides with more or less numerous black reticulated spots, between which a few red ones are interspersed. Dorsal with black spots.

Probably a non-migratory species from Loch Stennis, in the Orkney Islands.

a–b. Twelve and nine inches long, males. Loch Stennis. From the Haslar Collection.

Sir J. Richardson mentions this trout in the Faun. Bor.-Amer. Fish. p. 142, referring it to the "Frith-Trout"; but this appears to have the maxillaries feebler, and the scales smaller.

20. Salmo ferox.

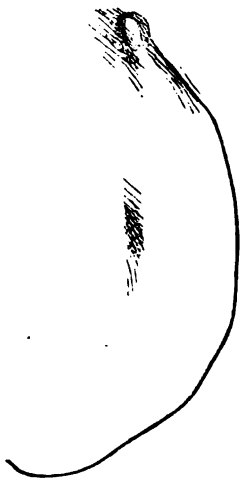
The Great Lake Trout.

Salmo lacustris, *Berkenhout, Syn. Nat. Hist. Great Brit.* 1795, i. p. 79.
—— ferox, *Jardine & Selby, Edinb. New Philos. Journ.* 1835, xviii. p. 55; *Jardine, Salmon*, pl. 4 (gill-covers badly drawn); *Yarrell, Brit. Fish.* 2nd edit. ii. p. 110, 3rd edit. i. p. 288; *Richards. Faun. Bor.-Amer. Fish.* p. 144.
Salar ferox, *Cuv. & Val.* xxi. p. 338.

D. 13. A. 10–11. P. 16. V. 9. L. lat. 125. L. transv. 26/30. Cæc. pyl. 44–49. Vert. 58–59.

Largest specimen observed, 31 inches; female mature at a length of 14 inches.

Head well proportioned in its shape, and of moderate size when compared with the body, but large in mature males; body stout; hinder part of the tail rather short. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. *Præoperculum crescent-shaped, the hinder and lower margins passing into each other without forming an angle.* Snout conical, much produced in the male sex, in which, during the spawning-season, a mandibulary hook is developed. Maxillary much longer than the snout, generally curved, solid, but rather narrow; in specimens 18 inches long it extends to the vertical from the hind margin of the eye, and much beyond it in adult males. Teeth strong: the head of the vomer small, triangular, broader than long, toothless; the body of this bone armed with a double or zigzag series of teeth, the teeth being alternately placed, forming nearly a single series behind; they are persistent throughout life. Fins rather short, and obtuse; the length of the pectoral is one-half or rather less than one-half of the distance of its base from that of the ventral. The caudal fin is perfectly truncate in specimens 18 inches long, and in old individuals rather convex. There are from thirteen to sixteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.



Præoperculum.

Upper parts deep purplish brown, sides of the head and body with more or less numerous round deep-black spots, which have a pale or blood-red margin during the spawning-season. Dorsal fin with smaller black spots; extremities of the fins blackish, without light margin. Other specimens are bright silvery on the sides, with numerous reticulated black spots.

A non-migratory species inhabiting the large lochs of the north of Scotland, and several lakes of the north of England, Wales, and Ireland.

The young specimen from Ireland, figured by Yarrell, is probably a *Salmo trutta*, at all events not a *S. ferox*; he confounded with it also the large species of Lake Wenern, in Sweden.

a–d. Skins, from 18 to 30 inches long. Loch Shin, Sutherland. Presented by Edw. Wilson, Esq.

e. Fine male specimen, 21 inches long. Sutherlandshire. Presented by W. Peel, Esq. Caught in June. Cæc. pyl. 45.

f–m. From 8 to 19 inches long. Derwentwater, Cumberland. Purchased of Mr. Wright. Caught in June. Cæc. pyl. 43.

n. Fine male specimen, 20 inches long. Lake of Llanberris. Presented by S. P. W. Ellis, Esq. Caught in the month of November. Cæc. pyl. 46.

o, p. Skins, 25 and 31 inches long. From Mr. Yarrell's Collection.

q. Fine male specimen, 31 inches long. Lough Melvin, Ireland. Presented by the Earl of Enniskillen. Caught in October. Cæc. pyl. 49.

r. Skeleton: half-grown male. Derwentwater. Purchased of Mr. Wright.

Description of an adult male specimen from the Lake of Llanberris, taken during spawning-time, at the beginning of November.

	inches.
Total length	21
Greatest depth of the body	4⅝
Length of the head	5⅛
Girth of the biggest part of the body	11
Least depth of the tail	1¾
Girth of the narrowest part of the tail	4¼
Distance between end of snout and eye	1⅞
Diameter of the eye	⅝
Length of the maxillary bone	2⅜
Distance between eye and angle of præoperculum	1⅞
Greatest width of operculum	1 3/16
Greatest depth of operculum	1⅜
Distance between occiput and origin of dorsal fin	5⅜
Distance between end of dorsal and root of caudal fin	6¼
Length of base of dorsal	2
Greatest height of dorsal	1¼
Length of pectoral	2⅛
Distance between root of pectoral and root of ventral	5¼
Length of ventral fin	2⅛
Distance between root of ventral and origin of anal	3¾
Length of anal fin	1⅝
Greatest depth of anal	2¼
Length of longest caudal ray	2⅝
Length of middle caudal ray	1⅞

The greatest depth of the body is below the origin of the dorsal fin, and is little less than one-fourth of the total length (without caudal); the length of the head is almost two-sevenths of the same.

The snout is much produced, pointed, and one-third the length of the head, or about five-sixths of the maxillary bone; the lower jaw has a terminal hook one-fourth of an inch in height, and the contact of the jaws laterally is interrupted. The maxillary bone exceeds the length of the snout by two-thirds of the diameter of the eye, it extends far beyond the hinder margin of the orbit, and its greatest width is equal to nearly two-thirds of the diameter of the eye.

Teeth strong, those of the intermaxillary and mandible larger than those of the maxillary and palatine bones. The vomerine teeth extend far back on the palate, and are arranged in a double series, the teeth of each pair being generally placed side by side.

The interorbital space is convex, about half the length of the postorbital part of the head, or two-thirds that of the maxillary bone. The eye is situated somewhat below the upper profile of the head.

The præoperculum has the hinder margin rounded, the lower limb being very indistinct and extremely short; the hinder margin of the operculum is also rounded; its point of junction with the inferior limb is a right angle. The suboperculum is broad, about half as broad as long. The distance from the upper end of the gill-opening to the angle of the operculum is greater than that from the latter point to the lower anterior end of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if measured back from behind that fin, reaches considerably more than halfway between the adipose and the root of the caudal. The dorsal fin is higher than long, and consists of thirteen rays, of which the first and second are rudimentary, the third simple and shorter than the following one, which is branched and the longest of the fin; the final ray is cleft throughout.

The anal fin is higher than long, and consists of twelve rays, the first two being rudimentary, the third simple, and the fourth branched and the longest of the fin; the last ray is cleft to its base.

The pectoral fin is shorter than the postorbital part of the head, and does not reach halfway towards the root of the ventral. The ventral fin is shorter, and reaches more than halfway towards the vent; its outermost ray is vertically opposite the ninth of the dorsal. Posterior margin of the caudal truncate.

There are 128 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to the lateral line has thirty scales; that from behind the adipose forwards to the lateral line has fifteen scales; there are about 24 longitudinal series between the lateral line and the ventral fin. The skin is very thick, enveloping completely the scales on the back and on the belly.

Upper parts dark greenish brown; sides lighter; lower parts whitish, with large blackish patches; sides of the head and body with

irregularly rounded black spots in moderate number, and with a few black ocelli, each with a red centre. Dorsal fin with small black spots; the other fins blackish.

21. Salmo stomachicus.

The Gillaroo.

Barrington, Philos. Trans. 1774, vol. 64. p. 116; *Watson, ibid.* p. 121; *Hunter, ibid.* p. 210; *Owen, Cat. Phys. Ser. Coll. Surg.* i. p. 141; *Thompson, Nat. Hist. Ireland*, iv. p. 154; *Sowerby, Brit. Miscell.* t. 61; *Yarrell, Brit. Fish.* 3rd edit. i. p. 283; *Couch, Fish. Brit. Isl.* iv. p. 240, pl. 219.

D. 15. A. 12–13. P. 13. V. 9. L. lat. 125. L. transv. 28/33. Cæc. pyl. 44. Vert. 59–60.

Head well proportioned in its shape, and rather small when compared with the body; body rather compressed and deep. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening; præoperculum with a rather distinct, but very oblique lower limb. Snout rather obtuse. Maxillary much longer than the snout, strong and much dilated; in specimens 6 inches long it reaches beyond the centre of the orbit, and in others, 14 inches long, it does not quite extend to the vertical from the hind margin of the orbit. Teeth small; vomer with a very small triangular head, and with the teeth of its body disposed in a double series, and persistent throughout life. Fins well developed, not rounded; the pectoral is pointed, its length being more than one-half of its distance from the root of the ventrals. The caudal fin has always the lobes pointed, is emarginate, and appears truncate only when stretched to the utmost extent. In specimens 14 inches long the middle caudal rays are a little more than half as long as the outer ones. The hinder part of the tail is much compressed and rather deep. There are from twelve to thirteen scales in a transverse series descending from behind the adipose fin to the lateral line.

Back and sides with numerous reticulated black spots, between which red ones are interspersed on and below the lateral line. Dorsal with ovate black spots; dorsal, anal, and caudal with a whitish margin.

The membranes of the stomach are conspicuously thicker in this species than in its congeners; but more so in adult examples than in young ones. It feeds exactly on the same shells (*Limnæus, Ancylus*) which are frequently found in other species without this peculiarity of the stomach.

Lakes of Ireland.

a, b, c. Many examples from 6 to 14 inches long: not in good state. Lough Melvin. Presented by the Earl of Enniskillen.

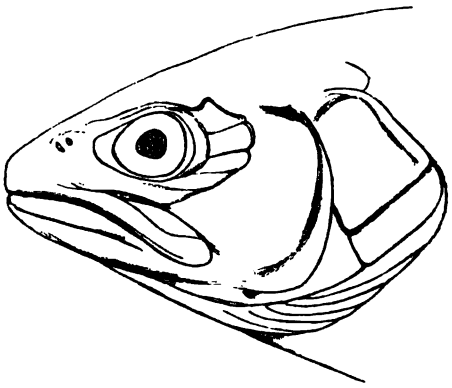
The following specimens from Lough Earne probably belong to a distinct species; but our materials are, at present, not sufficient to introduce it under a new name. The smaller examples were received without intestines; so that we cannot decide whether the great

number of pyloric appendages (57) found in the large example is constant in this Trout.

a. Female, 29 inches long. Lough Earne. Presented by the Earl of Enniskillen. Caught in the beginning of November; ova nearly mature, but still attached to the ovary; Cæc. pyl. 57.

b–f. From 15 to 18 inches long: not in good state. Lough Earne. Presented by the Earl of Enniskillen.

22. Salmo nigripinnis.



Specimen *a*, nat. size.

D. 14. A. 12. P. 13. V. 9. L. lat. 120–125. L. transv. 30/28. Cæc. pyl. (36, Ireland –) 40–42. Vert. 57–58 (–59, Ireland).

Largest specimen observed 16 inches; female mature at a length of 7 inches.

Head well proportioned in its shape, and small when compared with the body; body less stout than in *S. fario*. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum generally with an indistinct lower limb. Snout short, conical, not much produced in the male sex, in which a mandibular hook has never been observed. Maxillary much longer than the snout, but much narrower and more feeble than in *S. fario*; in specimens 8 inches long it does not extend to below the hind margin of the orbit, and at no age does it reach much beyond it. Teeth moderately strong. The head of the vomer is triangular, broader than long, with a transverse series of teeth across its base; the teeth of the body of the vomer form a single series, and only now and then two teeth stand opposite to each other: these teeth are persistent throughout life. Fins well developed, not rounded; the pectoral is pointed, and its length is nearly always more than one-half of the distance of its base from that of the ventral. The caudal fin has always the lobes pointed, is emarginate, and appears truncate only when stretched to the utmost extent. In specimens

8 inches long the middle caudal rays are half as long as the outer ones, and in old examples once and three-quarters. The hind part of the body is short and rather high. There are about fifteen scales in a transverse series descending from behind the adipose fin obliquely forwards to the lateral line.

Upper parts dark, with a greenish or reddish hue; scales on the sides with dark margins and base, silvery in the middle. Sides with round, sometimes ocellated, sometimes reticulated black spots; sometimes a series of red spots along the lateral line. Dorsal with black spots; vertical fins and outer halves of paired fins black.

A non-migratory species inhabiting mountain-pools of Wales, also Lough Melvin, Ireland; readily distinguished from *S. fario* by its feeble maxillary, uniserial vomerine teeth, long and black pectorals, and more or less emarginate caudal fin.

a–f. Males and females, from 7 to 12 inches long. Llyn Beguilin, Merionethshire. Presented by Dr. A. Günther; caught in the month of August.

g–i. Mature male and females, from 7 to 8 inches long. Llyn Gadr, Cader Idris. Presented by Dr. A Günther; caught in the month of August.

k–l. Sterile specimens, probably from the Towey, from which river they had been transferred to a freshwater-pond. Presented by W. Peel, Esq.

m. Many specimens. Lough Melvin. Presented by the Earl of Enniskillen. Caught in October; Cæc. pyl. 36, 36, 41. Vert. 58, 59, 59.

A deformed example of this species has been figured and described as the "Hog-backed Trout of Plinlimmon" (Cambr. Quart. Mag. 1833, July, p. 391). A similarly deformed specimen has been examined by Cobbold (Edinb. New Philos. Journ. vol. ii. 1855, pl. 6).

Description of a Female specimen from Llyn Beguilin, caught in the month of August; ova considerably enlarged.

	inches.
Total length	11⅜
Greatest depth of the body	2⅛
Length of the head	2¼
Girth of biggest part of body	6¼
Least depth of the tail	1
Girth of narrowest part of tail	2⅛
Distance between end of snout and eye	⅛
Diameter of the eye	⅛
Length of the maxillary bone	1
Distance between eye and angle of præoperculum	⅞
Greatest width of operculum	⅛
Greatest depth of operculum	⅛
Distance between occiput and origin of dorsal fin	3⅛
Distance between end of dorsal and root of caudal	3⅞
Length of base of dorsal	1¼

	inches.
Greatest height of dorsal	$1\frac{1}{4}$
Length of pectoral	$1\frac{2}{3}$
Distance between root of pectoral and root of ventral	3
Length of ventral fin	$1\frac{1}{4}$
Distance between root of ventral and origin of anal	$2\frac{1}{8}$
Length of anal fin	1
Greatest depth of anal	$1\frac{1}{4}$
Length of longest caudal ray	$1\frac{1}{2}$
Length of shortest caudal ray	$\frac{1}{8}$

The greatest depth of the body is below the origin of the dorsal fin, and is one-fourth of the total length (without caudal), the length of the head being two-ninths of the same.

The snout is rather short, conical, and less than half the length of the postorbital portion of the head; the length of the maxillary bone is equal to that of the snout together with the entire diameter of the eye, its greatest width is one-half of that diameter, the eye being small in this species as compared with its congeners; the jaws are very feeble.

Dentition rather feeble, the intermaxillary and palatine teeth being equal in size and much smaller than those of the mandible; the vomerine teeth form a single or partly zigzag series.

The interorbital space is rather convex, with an elevated median ridge, and the eye but slightly below the upper profile of the head; the width of this space is equal to half the length of the postorbital region of the head, or about three-fifths of that of the maxillary bone.

The posterior margin of the præoperculum is convex, the angle rounded, and the lower limb indistinct; the posterior margin of the operculum is straight, oblique, and forms a right angle with the lower limb; the distance from the upper end of the gill-opening to the angle of the operculum exceeds that from the latter point to the lower anterior end of the suboperculum: suboperculum more than twice as long as broad.

The distance of the origin of the dorsal fin from the occiput, if measured back from behind that fin, reaches to one-third of the distance between the adipose and the root of the caudal. The dorsal fin is as long as high, and is composed of fourteen rays, the first three of which are rudimentary, the fourth simple and shorter than the fifth, which is branched and the longest ray of the fin; the last ray is cleft to its root.

The anal fin is four-fifths as long as high, and possesses twelve rays, the first and second being rudimentary, the third simple and somewhat shorter than the following, which is branched; the fifth is the longest of the fin, and the terminal ray is cleft throughout.

The pectoral fin is three-eighths of an inch longer than the post-orbital portion of the head, and rather more than one-half of the distance of its root from that of the ventral fin: the latter fin is more than one-half as long as the distance of its root from the vent; its outer ray is in the vertical from the tenth of the dorsal fin.

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The caudal is very slightly emarginate, and has the lobes pointed.

There are 121 transverse rows of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to the lateral line has 30 scales; that from the hinder end of the adipose to the lateral line has 16 scales; there are 22 longitudinal series between the lateral line and the ventral fin. All the scales are rounded and without median ridge.

Greenish brown, each scale with a silvery centre, which is smallest in the scales on the back, and largest in those on the side; belly with a greyish hue; a few rounded, reticulated black spots on the sides, and a series of red ones along the lateral line. Operculum with a large silvery blotch. All the fins dark-coloured; the dorsal with rounded black spots of moderate size.

Description of a Male specimen from Llyn Gadr, caught in the month of August (testicles well developed).

	inches.
Total length	8
Greatest depth of the body	1⅝
Length of the head	1¾
Girth of biggest part of the body	4
Least depth of the tail	¾
Girth of narrowest part of tail	2
Distance between end of snout and eye	⅜
Diameter of the eye	*not quite* ⅜
Length of the maxillary bone	⅜
Distance between eye and angle of præoperculum	⅛
Greatest width of operculum	⅛
Greatest depth of operculum	⅛
Distance between occiput and origin of dorsal fin	1⅛
Distance between end of dorsal and root of caudal	2⅞
Length of base of dorsal	⅞
Greatest height of dorsal	1⅛
Length of pectoral	1⅜
Distance between root of pectoral and root of ventral	2
Length of ventral fin	1⅛
Distance between root of ventral and origin of anal	1⅜
Length of anal fin	⅝
Greatest depth of anal fin	1
Length of longest caudal ray	1¼
Length of shortest caudal ray	⅛

The greatest depth of the body is below the origin of the dorsal fin, nearly equal to the length of the head, and contained four times and one-third in the total length (without caudal).

The snout is rather short and obtuse, its length is equal to that of the diameter of the eye, and rather less than half of that of the post-orbital portion of the head; the length of the maxillary bone is equal to that of the snout together with the diameter of the eye; its

greatest width being less than one-half of the latter. The lower jaw is without any trace of a hook, and the mouth closes perfectly.

Teeth of moderate strength; those on the vomer are in a single, and partly zigzag, series.

The interorbital space is flattened, with the median ridge not much elevated; the eye is immediately below the upper profile of the head: the width of this space is less than the distance from the eye to the angle of the præoperculum, or three-fifths of the length of the maxillary bone.

The posterior margin of the præoperculum is rounded, the lower limb being very indistinct: posterior margin of the operculum straight, meeting the lower at a right angle. The distance from the upper end of the gill-opening to the angle of the operculum is greater than that from the latter point to the lower anterior end of the suboperculum. Suboperculum thrice as long as broad.

The distance of the origin of the dorsal fin from the occiput is equal to that from the root of the last ray of that fin to the hinder end of the adipose*. The dorsal fin is higher than long, and possesses fourteen rays, the three first of which are rudimentary, the fourth simple, the fifth branched and the longest of the fin, and the last one cleft to its base.

The anal fin is two-thirds as long as high, and consists of twelve rays, the first two of which are rudimentary, and the third simple; the fifth is the longest ray, and the terminal ray is cleft throughout.

The pectoral fin is long, reaching more than midway between its root and that of the ventral fin; the latter fin is equal in length to three-fourths of the distance of its root from the vent: its outer ray is vertically opposite the eleventh of the dorsal fin. Caudal emarginate, with the lobes pointed.

There are 122 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin to that line has 28 scales; the series descending obliquely forwards from the hinder end of the adipose to the lateral line has 16 scales; there are 23 longitudinal series between the lateral line and the root of the ventral fin.

Back blackish, with silvery lustre; sides and belly greyish, each scale with the centre silvery: numerous black ocelli, of a smaller and larger size, and surrounded by a whitish rim, occupy the sides, particularly of the trunk. Operculum with a silvery blotch, and with two or three black spots. Dorsal, ventral, and anal fins with a black and white outer margin; the first with two or three series of ovate deep-black spots of moderate size. Caudal and posterior third of pectoral blackish.

* This peculiarity of the forward position of the dorsal fin is found again in a second (female) example from the same locality; however, that this is not a specific character is evident from a third (male) specimen, also from Llyn Gadr, in which the distance of the dorsal from the occiput is considerably more than its distance from the adipose fin.

23. Salmo levenensis.

Salmo levenensis, *Walker, Wern. Mem.* i. p. 541; *Yarrell, Brit. Fish.* 2nd edit. ii. p. 117; 3rd edit. i. p. 257.
Loch Leven Trout, *Richards, Faun. Bor.-Amer. Pisc.* p. 143.
—— cæcifer, *Parnell, Fish. Firth of Forth*, p. 146, pl. 30 (young, not good).

D. 13. A. 11. P. 14. V. 9. L. lat. 118. L. trans. 28/26. Cæc. pyl. normally 60–80. Vert. 59.

Largest specimen observed, 21 inches; female mature at a length of inches.

Head well proportioned in its shape, and rather small when compared with the body; body much less stout than in *S. fario*. The posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum generally with a very indistinct lower limb. Snout of moderate length, conical, not much produced in the male sex, in which a mandibular hook has never been observed. Maxillary much longer than the snout, but much narrower and more feeble than in *S. fario* (see p. 6); in specimens 13 inches long it extends to below the hinder margin of the orbit, and at no age does it reach much beyond it. Teeth moderately strong; the head of the vomer is triangular, a little broader than long, with a transverse series of two or three teeth across its base; the teeth of the body of the vomer form a single series, and are persistent throughout life. Fins well developed, not rounded; the pectoral is pointed, and in specimens of more than 12 inches in length its length is less than one-half of the distance between its base and that of the ventral. The caudal fin always has the lobes pointed, is emarginate, and appears truncate only when stretched to the utmost extent. In specimens 13 inches long the middle caudal rays are not quite half as long as the outer ones, and in older ones they are half as long. The hind part of the body is rather slender. There are from thirteen to fourteen scales in a transverse series descending from behind the adipose fin forwards to the lateral line.

Upper parts brownish or greenish olive; sides of the head with round black spots; sides of the body with more or less numerous X-shaped, sometimes rounded brown spots. Dorsal and adipose fins with numerous small brown spots; extremity of pectoral light blackish; dorsal and anal without black or yellow margin.

A nonmigratory species, inhabiting Loch Leven and other lakes of southern Scotland and of the north of England.

a–d. Skins: from 14 to 18 inches long. Loch Leven. From Mr. Parnell's Collection.

e, f. Thirteen inches long. Loch Leven. Presented by Sir J. Richardson.

g–n. Females, from 12 to 18 inches long. Purchased, said to be from Loch Leven. Caught in April. Cæc. pyl. 65, 63, 60, 54, 54, 53, 49; Vert. 58–59. These specimens have the pyloric appendages fewer in number than is generally stated; yet these

cæca are so wide—so much wider than in *S. fario*, that the reduction of their number has evidently been caused by a confluence of several cæca into one.

o–v. Skins, from 9 to 19 inches long. Loch Scone, Perthshire. From Mr. Parnell's Collection. Caught in the month of July.

w–β. Skins, from 8 to 19 inches long. River Forth. From Mr. Parnell's Collection.

γ. Skin, 12 inches long. Branch of Loch Lomond. From Mr. Parnell's Collection. Caught in the month of September.

δ. Skin, 21 inches long. Loch Lomond. From Mr. Yarrell's Collection. This is probably the specimen which served for the woodcut heading Yarrell's description of *Salmo levenensis*.

ε. Skin, 15½ inches long. From Mr. Yarrell's Collection.

ζ. Stuffed, 20 inches long. Lake Windermere. Presented by Sir J. Richardson.

η. Nine inches long. From the Collection of the Zool. Soc. Cæc. pyl. 78.

θ. Skin, 11 inches long. Lake Windermere. From Mr. Yarrell's Collection.

ι–κ. Seven inches long. Windermere. Purchased of Mr. Wright. Cæc. pyl. 65.

λ–μ. Seven inches long. Rothay River, Westmoreland. Purchased of Mr. Wright. Cæc. pyl. 71.

Description of a Male specimen.

	inches.
Total length	13½
Greatest depth of the body	2⅔
Length of the head	2⅔
Girth of biggest part of the body	6
Least depth of the tail	1⅛
Girth of the narrowest part of the tail	2⅜
Distance between end of snout and eye	⅝
Diameter of the eye	⅓
Length of the maxillary bone	1⅝
Distance between eye and angle of præoperculum	1
Greatest width of operculum	⅝
Greatest depth of operculum	⅞
Distance between occiput and origin of dorsal fin	3¾
Distance between end of dorsal and root of caudal	5
Length of base of dorsal	1 3/16
Greatest height of dorsal	1⅛
Length of pectoral	1⅞
Distance between root of pectoral and root of ventral	3¼
Length of ventral fin	1⅝
Distance between root of ventral and origin of anal	2½
Length of anal fin	⅞
Greatest depth of anal	1¼
Length of longest caudal ray	1⅞
Length of middle caudal ray	1

The greatest depth of the body is below the origin of the dorsal fin, and is two-ninths of the total length (without caudal), being about equal to the length of the head. The snout is moderately produced, conical, and rather less than one-fourth the length of the head, or more than half that of the maxillary bone. The lower jaw is without a trace of a hook, and the mouth closes perfectly. The maxillary bone is longer than the snout by almost the entire diameter of the eye; it extends slightly beyond the posterior margin of the orbit, and its greatest width is equal to one-half of the diameter of the eye.

The teeth of the intermaxillary and mandible are larger than those of the maxillary and palatine bones. Of the vomerine teeth, there remain but two on the posterior ridge of the head of that bone, the rest being arranged in a partially zigzag, partially single series.

The interorbital space is slightly convex, its width being equal to three-fifths of the length of the postorbital part of the head, or four-fifths of that of the maxillary bone. The præoperculum has the hinder margin slightly undulated, the angle rounded, and the inferior limb oblique but distinct. The angle of the operculum is an obtuse one, and its distance from the upper end of the gill-opening exceeds that from the lower anterior end of the suboperculum. Suboperculum narrow, thrice as long as broad.

The distance of the origin of the dorsal fin from the occiput, if measured back from behind that fin, reaches to one-fourth of that between the adipose and the root of the caudal. The dorsal fin is higher than long, and consists of thirteen rays, of which the first three are rudimentary and covered by the skin, the fourth simple, the fifth the first branched ray, and the last ray cleft to its base.

The anal fin is much higher than long, and consists of twelve rays, the first three of which are rudimentary, the fourth being simple, and the last ray cleft to its base.

The pectoral fin is longer than the postorbital portion of the head, reaching almost midway towards the root of the ventral. The latter fin is a little shorter than the pectoral, and reaches rather more than halfway in the direction of the anal fin, its outermost ray being vertically opposite the ninth of the dorsal fin. Posterior margin of the caudal emarginate.

There are 117 transverse series of scales, counted immediately above the lateral line; the series descending obliquely backwards from the origin of the dorsal fin has twenty-seven scales, that from behind the adipose forwards to the lateral line has fifteen. There are twenty-two longitudinal series between the lateral line and the ventral fin. Scales rounded; in dried specimens a slight median ridge becomes distinct on each scale.

Bright silvery, with a reddish or greenish hue on the back; sides with numerous large broad X-shaped black spots; operculum with several round black spots. Dorsal fin spotted, the other fins immaculate, of uniform coloration.

IX. *Scandinavian Peninsula and Finland.*

We may infer, from the geographical situation and the climate of the Scandinavian peninsula with its innumerable rivers and lakes, that it is inhabited by a still greater number of species than Great Britain; and indeed the limited number of examples which we have received from those countries give sufficient evidence that this is really the case. However, our knowledge of them is very scanty, the Scandinavian authors not having gone into those details of examination which are necessary for the distinction and determination of the species.

Nilsson describes the following species:—

1. *Salmo salar.*

2. *Salmo eriox*: this description is taken from old examples either of one of the species confounded under the name of *S. ocla*, or of *S. trutta.*

3. *Salmo ocla* is evidently a compound of several species: migratory Trout ascending from the sea are identified with Lake-Trout, of which the Wenerns lax (*S. venernensis*) is one. As the characters are very indefinite, we cannot decide whether the name of *S. ocla* should be preserved to one of the species described by us, and we must leave it to Scandinavian naturalists to fix this name to that species of which "Okla" may be a vernacular term.

4. *Salmo lacustris* is perhaps our *S. hardinii.*

5. *Salmo trutta* may be identical with our *S. trutta.*

6. *Salmo ferox*, perhaps identical with the British *S. ferox*, but neither the form of the præoperculum nor the number of pyloric appendages are noticed.

7. *Salmo fario.*

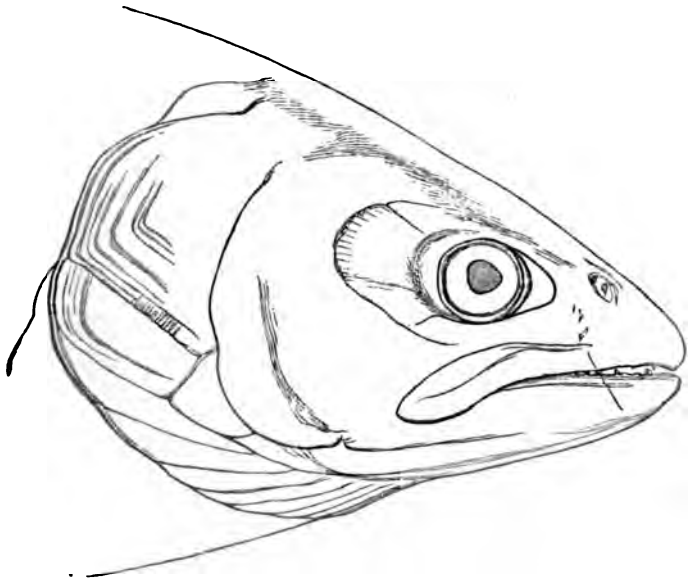
For completeness' sake we must mention that H. Widegren, in a paper published in 'Öfvers. Vetensk. Akad. Förhandl.' 1863, has attempted to show that the River-Trout, Lacustrine Trout (*S. lacustris*, *S. ferox*, *S. microps*, &c.), and the Sea- or Salmon-Trout, are all one and the same species, which assumes a different appearance according to the locality inhabited by the several individuals. He names this species *Salmo trutta*; so that Scandinavia and the remainder of Europe would be, in fact, inhabited by two species only, viz. this *S. trutta* and *S. salar.*

In this he is partly opposed by Malmgren in his "Kritisk Öfversigt af Finlands Fisk-Fauna," Helsingfors, 1863, translated into German in 'Wiegm. Arch.' 1864, p. 259, of which paper we have given a critical review in the 'Record of Zoolog. Literat.' 1864, p. 178. This author adopts Widegren's view as to the existence of only two species in Scandinavia, but he considers it improper to refer the various "varieties" to one species without taking due notice of them. In fact, what has been called a species is represented as a variety by this author, who, at the same time, does not hesitate to use binomial nomenclature for these "varieties." He has not given any serviceable description by which the knowledge of the fishes of that country would be enlarged. He mentions a lacustrine form from Lake Ladoga,

which he regards as a descendant of *S. salar*, naming it *Trutta relicta*. This is probably a distinct species; but the author has omitted to point out its characters, except one, viz. that the ova of *Trutta relicta* are considerably smaller than those of the Salmon.

After these preliminary remarks, we proceed to give descriptions of those of the Scandinavian species which we were enabled to distinguish among the specimens in the British Museum Collection, and which, for the present, we must consider to be peculiar to that peninsula. Others, common to other parts of Europe, have been mentioned above. There is no doubt that more forms will be found in that country; and we have several examples which we cannot refer to any of the known species, but the description of which must be deferred until the specific characters can be better defined by the examination of a greater number of examples.

24. Salmo mistops.



Female, 17 inches long. Nat. size.

B. 11–12. D. 14. A. 12. P. 14. V. 9. L. lat. 118. L. transv. 26/34. Vert. 59–60. Cæc. pyl. 43–52.

Head small, convex above, with the snout of moderate length, and much pointed. Operculum and suboperculum of moderate width and depth; præoperculum with the lower limb rounded. *Eye extremely small**. The posterior point of junction of operculum and suboper-

* Its diameter is 6 lines in a specimen 17 inches long, 5 lines in one of 15 inches, and 4½ lines in one of 12 inches.

culum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Maxillary very narrow and feeble*, extending somewhat beyond the hind margin of the orbit in females 17 inches long, and to the hind margin in young examples of 9 inches in length. Dentition feeble; the vomerine teeth form a single series, and are gradually lost with age. Fins moderately developed; pectoral rather obtuse: caudal fin truncate in mature examples (from 12 inches in length), with the lobes acutely pointed; in younger examples of 9 inches in length, the middle rays are rather more than half as long as the outer ones. Tail rather broad, covered with rounded scales, which are a little larger than those of the trunk. There are fifteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.

Silvery, with scattered, black, X-shaped spots. No parr-marks in a specimen of 9 inches in length.

A migratory species, from the Eidfjord River in Norway, remarkable for the small size of the eye, and closely allied to *S. gallivensis*.

a–c. Females, from 12 to 17 inches long. Presented by Professor N. S. Maskelyne. Caught in August.

d. Nine inches long. Presented by Professor N. S. Maskelyne.

Description of a Female 17 *inches long. Ova semimature.*

The greatest depth of the body is below the origin of the dorsal fin and is contained thrice and two-thirds in the total length (caudal not included); the length of the head is two-ninths of the same. The snout is slightly produced, much pointed, and one-half of the length of the postorbital portion of the head. The maxillary is longer than the snout by somewhat more than one-half the diameter of the eye, and extends about one-eighth of an inch behind the vertical from the hinder margin of the orbit; the width of its broadest part is one-half of the diameter of the eye (after the skin has been removed from the bone). The dentition of the jaws and palate is feeble, the teeth of the tongue and mandible being larger than those of the intermaxillary, which, again, exceed slightly those of the maxillary and palatine bones, which are about equal. The vomer has the head of an irregular shape, the anterior margin being deeply notched; it is toothless; the longitudinal series is formed by three small teeth, the ridge of the body of the bone being very low.

The distance of the nostrils from the orbit is about three-fourths of the diameter of the latter; the interorbital space is very convex, the orbit being far below the upper profile of the head; the width of this space is one-fourth of an inch less than the length of the maxillary bone, and two-thirds of the length of the space between the pupil and the angle of the præoperculum. The præoperculum has the posterior margin, angle, and lower limb rounded, the latter being well developed. The posterior margin of the operculum is curved, and forms a somewhat obtuse angle with the lower margin. A line

* This is especially striking when the bone is divested of the covering skin.

taken from the upper end of the gill-opening to the angle of the operculum is longer than a line from the latter point to the lower anterior angle of the suboperculum.

The distance of the origin of the dorsal fin from the occiput, if measured behind that fin, reaches to the hinder third of the distance between the adipose and the root of the caudal. The dorsal fin is as long as high, and composed of fourteen rays, the three anterior ones being rudimentary and enveloped in the skin; the fourth ray is simple, and nearly as long as the fifth and sixth rays, which are equal and the longest of the fin, the fifth being the first branched ray; the last ray is cleft to the base. The anal fin is one-fourth higher than long, and composed of twelve rays, the first three being rudimentary and enveloped in the skin, the fourth simple, nearly as long as the fifth, which is branched and the longest of the fin; the last ray is split to the base. Pectoral longer than the postorbital portion of the head. Ventral shorter, its length being a little more than half the distance of its root from the anal; its outer ray is in the vertical from the tenth of the dorsal. Posterior margin of caudal truncate, with the lobes acutely pointed.

There are about 120 transverse series of scales, counted immediately above the lateral line; the transverse series descending obliquely backwards from the origin of the dorsal fin to the lateral line contains twenty-six scales, and there are twenty-two or twenty-three longitudinal series between the lateral line and the root of the ventral. The transverse series descending forwards from behind the adipose fin contains fifteen scales: all the scales are very thin, irregularly rounded behind.

Bright silvery, greenish on the back; sides with a few black X-shaped spots. Gill-cover and upper side of the head with round black spots. Dorsal fin with a few black specks; the other fins immaculate.

25. Salmo hardinii.

Deijefors-Lax.

? Salmo lacustris, *Nilss. Skand. Faun. Fisk.* p. 404.

Salmo salar, var. lacustris, *Hardin, in Öfvers. Vetensk. Akad. Förhandl.* 1862, (1861) p. 382.

Silfver-lax, *Lloyd, Scand. Advent.* i. p. 116.

? Vetterns Silfver-lax, *Widegren, in Öfvers. Vetensk. Akad. Förhandl.* 1863, (1862) taf. 6. fig. 1.

D. 15. A. 12. P. 14. V. 9–10. L. lat. 122. L. transv. 22/30.

The depth of the head at the occiput equals the length of its postorbital portion; operculum rather higher than long; the posterior point of junction of operculum and suboperculum is a little nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Præoperculum with a very distinct inferior limb, which is more than half as long as the posterior. Snout rather pointed; maxillary longer than the snout, strong, extending to below the posterior margin of the orbit (in specimens 23 inches long). The

head of the vomer is toothless, subpentagonal, longitudinally elongate; the body of this bone with a sharp longitudinal ridge, which bears some erect teeth in a single series. Caudal fin deeply emarginate in a specimen 23 inches long, the length of one of the middle rays is two-fifths of that of the longest. There are thirteen scales in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.

Sides and belly bright silvery, back greenish; some scattered black spots on the head, body, and dorsal fin.

Lake Wenern (Sweden).

There can be no doubt that this is a very distinct species; the shape of the vomer and the forked caudal fin indicate its affinity to *S. salar*, but this species has considerably larger scales on the tail; moreover *S. hardinii* never enters the sea, being found in the Lake Wenern, into which no marine fish can ascend in consequence of intervening cataracts. A fanciful idea has been started, that it is a Salmon with some of the characters modified in consequence of its compulsory residence in a freshwater lake. We cannot see how such a change in the life of a fish has the effect of diminishing the size of the scales. Besides, we have no evidence whatever that a migratory species has ever been changed into a non-migratory one; and persons who bring forward instances of such changes having taken place in the course of a few years, must first prove that they have correctly determined the species of the specimens experimented upon.

The question whether this fish be not a sterile form of some other species is settled by the observations made by Magister Hardin, who has watched it successively for many years ascending the rivers from the lake for the purpose of spawning.

It is very doubtful whether this species was known to Artedi and Linnæus, and whether it ever will be possible to ascertain the Scandinavian species to which the latter might have applied the name of *S. lacustris*; if he really fixed this name upon a fish known to him from autopsy, he at all events confounded it with the species of Central Europe described by Gesner and his copyists as *Trutta lacustris*. And as the specific denomination of *lacustris* has always been retained for the latter, it appears much safer to give a new name to the Wenern fish than to that of Central Europe. The specimen described by Nilsson as *Salmo lacustris*? agrees very well with that examined by myself.

a. Female in spirits. Lake Wenern. Purchased of Mr. Wheelwright.

Description of this specimen.

	inches.
Total length	23
Greatest depth of the body	5
Length of head	$4\frac{5}{8}$
Girth of the biggest part of the body	12
Least depth of the tail	$1\frac{5}{8}$

	inches.
Girth of narrowest part of tail	$4\frac{3}{4}$
Distance between the end of the snout and the eye	$1\frac{3}{8}$
Length of the maxillary bone	$1\frac{3}{4}$
Distance between the eye and the angle of the præoperculum	$1\frac{5}{8}$
Greatest width of the operculum	$1\frac{3}{16}$
Greatest depth of the operculum	$1\frac{3}{8}$
Distance between occiput and origin of dorsal fin	$6\frac{1}{2}$
Distance between the end of dorsal and root of caudal fin	$6\frac{7}{8}$
Length of base of the dorsal	$2\frac{1}{2}$
Greatest height of the dorsal	$2\frac{5}{8}$
Length of the pectoral	$3\frac{1}{4}$
Distance between root of pectoral and root of ventral	$5\frac{1}{2}$
Length of the ventral fin	$2\frac{1}{4}$
Distance between root of ventral and origin of anal	$4\frac{7}{8}$
Length of the anal fin	$1\frac{3}{4}$
Greatest depth of the anal	$2\frac{1}{4}$
Length of the longest caudal ray	$3\frac{5}{8}$
Length of the middle caudal ray	$1\frac{1}{2}$

This specimen is a female, 23 inches long, with the ova perfectly developed, although the sexual organ is comparatively small.

The greatest depth of the body is below the origin of the dorsal fin, and nearly one-fourth of the total (without caudal); the tail is rather slender, its least depth being about one-third of the height of the body. The length of the head is one-fourth of the total (without caudal); its depth at the occiput equals the length of its postorbital portion; the snout is conical, rather pointed, not quite twice as long as the eye, the diameter of which is contained six times and one-third in the length of the head. The maxillary bone is longer than the snout, rather strong in its basal portion, the width of its dilated portion being three-fifths of that of the orbit; it extends backwards to the vertical from the posterior margin of the eye. Lower jaw moderately developed, with a very inconspicuous knob in front. Dentition perfect; the intermaxillary teeth are the strongest, as strong as those on the tongue, of which there are four pairs; *the head of the vomer is toothless, of subpentagonal shape, longitudinally elongate, with the two lateral margins longest; the body of the vomer is provided with a sharp longitudinal ridge, which bears some erect teeth, there being three on its anterior portion, and one in the middle of its length.*

The interorbital space is convex, with the median longitudinal ridge distinct, the eye being far below the upper profile of the head. The posterior margin of the operculum and suboperculum is irregularly semicircular, the posterior part of the curvature being considerably more curved than the lower; the posterior point of junction of operculum and suboperculum is a little nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening; operculum rather higher than wide; *the præoperculum has a very distinct inferior limb,* which is more than half as long as the poste-

rior, the two forming a rounded angle; the posterior præopercular edge descends obliquely backwards.

The distance of the dorsal fin from the occiput is somewhat less than its distance from the caudal fin. It is somewhat longer than high, and composed of fifteen rays, the two anterior of which are rudimentary, the third half as long as the fourth, which, together with the fifth (first branched ray) forms the highest point of the fin: the last ray is split to the base. The adipose fin is exactly above the end of the anal. Anal higher than long, composed of twelve rays, the two anterior of which are rudimentary, whilst the third, with the fourth (which is the first branched ray), forms the highest point of the fin; the length of the base of the anal is contained once and one-third in its distance from the caudal fin. Notwithstanding the age of the individual, *the caudal fin is still deeply emarginate, the length of one of the middle rays being two-fifths of that of the longest.* The length of the pectoral equals that of the head without snout, but is much more than that of the ventral, which exceeds one-half of the distance of its root from the anal fin.

There are 122 transverse series of scales, counted immediately above the lateral line; twenty-eight scales compose the transverse series descending obliquely backwards from the origin of the dorsal towards the lateral line; there are twenty-two longitudinal series between the lateral line and the root of the ventral. *The transverse line descending obliquely forward from the axil of the adipose fin to the lateral line is composed of thirteen scales.* All the scales overlap each other, scarcely a trace of the skinny pouches being visible, which circumstance gives a peculiarly bright aspect to the fish.

The entire fish of the brightest silvery colour, the back being slightly shaded with greenish; irregularly scattered black spots, some of which are as large as one scale, others of the size of three or four scales, occupy the parts above the lateral line. Several round, deep-black spots on the crown of the head and on the opercles, the lateral spots having a light centre: a few black spots on the base of the dorsal. Caudal, inner side of the pectoral, and ventral blackish.

26. Salmo venernensis.

Vår-lax.

? Salmo, *Artedi, Synon.* p. 23, no. 3; *Genera*, p. 12, no. 5; *Species*, p. 51, no. 4.

Wenerns-lax, *Lloyd, Scand. Advent.* i. p. 113.

Salmo microps, *Hardin, Öfvers. Vetensk. Akad. Förhandl.* 1861 (1862), p. 383.

B. 11. D. 14. A. 11. P. 14–15. V. 9. L. lat. 120.
L. transv. 28/34. Vert. 59–60. Cæc. pyl. 59–62.

Attaining to a length of more than 3 feet; female mature at a length of

Head rather high, compared with its length; eye small, its diameter being one-fourth, or rather less than one-fourth, of the length of the postorbital part of the head, in specimens from 12 to 24 inches

long. Suboperculum elevated, twice as long as deep. The posterior point of junction of operculum and suboperculum is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum with a distinct lower limb, and with the hind margin slightly emarginate above the angle. Snout of moderate length, produced in full-grown males, which have the lower jaw hooked during the spawning-season; maxillary longer than the snout, rather strong and broad, not reaching the posterior margin of the eye in examples 12 inches in length, and extending somewhat behind it in mature ones (from a length of 22 inches). Head of the vomer triangular, broader than long, with a transverse series of teeth across its hinder margin; body of this bone with a sharp longitudinal ridge, bearing a single series of teeth, the posterior of which are lost before the specimens attain a length of 18 inches; these teeth form a zigzag series in young examples. Fins not short. The caudal fin is slightly emarginate in specimens up to a length of 22 inches, in which the middle rays are only half as long as the outer, longest one. Tail covered with rounded scales; there are fourteen in a transverse series running from behind the adipose fin obliquely forwards to the lateral line.

Silvery; back with a brownish or greenish shade; sides with more or less numerous small, angular, sometimes X-like black spots; dorsal fin and opercles with a few rounded black spots.

Sweden (Lake Wenern); non-migratory.

This species is distinguished from *S. trutta* by a stronger maxillary, smaller eye, more deeply emarginate caudal fin, higher body, &c.

a–c. Males, 36 inches long: stuffed. River Gotha, near the Lake Wenern. From Mr. L. Lloyd's Collection.

d. Female, 22 inches long. Lake Wenern. Purchased of Mr. Wheelwright.—Cæc. pyl. 59; Vert. 59.

e. Twelve inches long, not in good state. Lake Wenern. Purchased of Mr. Wheelwright.

f–g. Nine inches long. River Gotha. From Mr. Lloyd's Collection. —Cæc. pyl. 61 and 62; Vert. 60 in both.

27. Salmo polyosteus.

B. 10. D. 13. A. 11. P. 14. V. 9. L. lat. 128.
L. transv. $\frac{\text{ca. } 28}{\text{ca. } 30}$. Vert. 61–62. Cæc. pyl. 40.

Head rather high, compared with its length; eye of moderate size, its diameter being rather more than one-fourth of the length of the postorbital portion of the head in specimens 16 or 17 inches long. Suboperculum rather narrow, nearly thrice as long as broad; the posterior point of junction of opercle and subopercle is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum subcrescentic, with the lower limb very indistinct. Snout of moderate length. Maxillary longer than the snout, broad, its greatest width being two-thirds of the diameter of the eye; it reaches to somewhat behind the vertical

from the posterior margin of the orbit in a male 17 inches long, and just below it in a female 16 inches long. Body of the vomer with teeth arranged in pairs, one tooth of every pair standing somewhat behind the other. Fins moderately developed, the length of the pectoral being one-half or less than one-half of its distance from the ventral. Caudal fin truncated, with the lobes rounded, the middle rays being more than half as long as the outer ones. Tail covered with thin, rounded scales; there are fifteen in an oblique series running forwards from behind the adipose fin to the lateral line.

Sides bright silvery, with small, irregular blackish spots; opercles with a few rounded blackish spots.

Lapland. This species is most probably non-migratory, as we may infer from its dentition, præoperculum, and caudal fin.

a. Male, 17 inches long: not in good state. From Mr. Wheelwright's Collection.

b. Female, 16 inches long: not in good state. From Mr. Wheelwright's Collection.

c–h. From 11 to 15 inches long: not in good state. From Mr. Wheelwright's Collection.

X. *Russia and Tartary.*

Pallas (Zoogr. Ross.-As. iii.) describes, beside the Salmon, Common River-Trout, *S. autumnalis*, and a species from the Neva and Terek, which he identifies with *S. eriox*, L., but names *S. spurius* (p. 343), two other species, both from the Crimea. The first is named *S. trutta*; but it is more than doubtful whether he has correctly determined it. As we have no specimens to decide this point, we are not entitled to propose a change in the specific denomination.

28. Salmo trutta (pallasii).

Salmo trutta, *Pall. Zoogr. Ross.-As.* iii. p. 347 (not synon.).

Pallas gives the following description:—

B. 11. D. 11. A. 9. P. 12. V. 9.

Length nearly 27 inches. Upper jaw the longer, obtuse; the teeth of its outer margin larger; smaller ones in double series on the palate and along the middle of the palate; "duo item majores in apice," and smaller ones in two series on the tongue. In the lower jaw there is a simple series of teeth, all those in front being the largest. Caudal even, truncated, brown, somewhat fleshy. Colour on the belly silvery, here and there with a black or red spot in the vicinity of the lateral spots. Numerous black spots on the back, towards the sides some ocelli with red centre, some red spots interspersed among the black ones; opercles of the gills with somewhat large black spots.

It is taken not unfrequently on the southern shore of the Crimea, and in the mountain-torrents when it enters them in summer, having been sometimes brought to me at Soldaja in the month of July. When it ascends the torrents it is regarded by the natives of the Crimea as

an omen of coming war, on account of its blood-red spots. This fish (which is one of the finest of its kind) has never to my knowledge been seen in the waters of Russia or Siberia.

29. Salmo labrax.

Salmo labrax, *Pall. Zoogr. Ross.-As.* iii. p. 346.

Pallas describes it as follows:—

D. 10. A. 9.

About an ell in length. Snout conical, with the jaws equal and armed with sharp teeth, tongue with stronger teeth. Body similar in appearance to that of *S. fario*, silvery white, without spots, becoming dusky on the back. Pectoral fins bluish; dorsal with black spots in irregular series, especially at the base; caudal truncated, with the angles pointed.

It is often killed with spears at the entrance of the harbour of Sebastopol, whence it frequently ascends into the river Bijukosen, and is occasionally taken about Cherson and at Otschakof, in the shallows and shoals, with spears or nets. It is good eating, the flesh becoming red in cooking.

30. Salmo autumnalis.

Salmo autumnalis, *Pall. Zoogr. Ross.-As.* iii. p. 355; *Cuv. & Val.* xxi. p. 258.

B. 11. D. 13. A. 12. P. 15.

Size a little exceeding that of *S. erythræus*, about two feet and a half; appearance similar. Head blackish, convex, beneath white: snout conical, obtuse, but less so than in *S. erythræus*, with the lower jaw frequently slightly bent upwards. Teeth slightly curved; larger ones in the lower jaw, which is somewhat the longer; middle-sized ones on the superior arch of the palate and the tongue: minute ones on the margin of the maxillary. Body low, compressed, in the female more ventricose, with small scales. Lateral line quite straight, slightly ascending, the branchial sinus beaded. Coloration above the line brownish, with a few dots near together of a whitish colour; below the lateral line greyish, with yellowish small quincunx-shaped spots; colour of the belly white, here and there becoming reddish, as though suffused with blood. Dorsal fin brown; adipose narrower at the base. Pectoral fins reddish. Ventrals bright red, with external margin white; accessory scale conspicuous, awl-shaped. Anal fin brownish red, with anterior margin white. Caudal brown, semibifid (as in *S. schiffermülleri*), robust, with the lobes pointed. Total length 1 foot 6 inches 3 lines; length of the head 3 inches 7 lines, of the tail 2 inches 5 lines; distance of dorsal fin from snout 7 inches 9 lines, of anal fin almost 1 foot, of adipose 1 foot 1 inch 2 lines.

In the month of October these fish ascend into the river Neva in shoals full of milt and spawn, and fall into the nets in large numbers. Scent very strong, offensive to Salmon, as also to Coregoni.

The fish for which Pallas intended the name of *S. autumnalis*, is perfectly unknown; it is evidently a migratory Trout, or perhaps a young Salmon. The specimen labelled *S. autumnalis* in the Berlin Museum, is a Charr from Kamtschatka (p. 144).

31. Salmo spectabilis.

Salar spectabilis, *Cuv. & Val.* xxi. p. 340. [On Salar spectabilis (*Heck. & Kner*), see p. 85].

Valenciennes gives the following description of this species without distinctly naming the locality where it was obtained:—

Vomerine teeth in a double series. It is distinguishable from all our Trouts by its fusiform and more regularly elliptical body. Its head is about one-fifth of the total length. The cleft of the mouth is moderate, a little less than one-third of the length of the head. The muzzle is pointed. The two jaws are equal. The præoperculum is regularly rounded. The eye is small; its diameter is contained six times and a half in the length of the head. The fins are small. The scales are more apparent, or, rather, less hidden by the mucosity of the skin.

There are 130 longitudinal series. The colour is steel-blue on the back, fading into silvery on the sides. The under surface of the belly and throat is dull-green. The sides and cheeks are scattered over with black spots. The largest of three specimens is 16 inches in length.

32. Salmo lepechini.

Pal'jæ, *Lepechin, Reise Russ. Reich.* iii. p. 229, taf. 14. fig. 2.
Salmo lepechini, *L., Gm.* i. p. 1374; *Cuv. & Val.* xxi. p. 342.

This fish is said to be found in the torrents of the Russian province Olonezk. The figure given by Lepechin is probably taken from a skin, and does not assist us in defining this species, if, indeed, it be distinct. The skin in the Berlin Museum from Pallas's Collection, named *S. lepechini*, and mentioned by Valenciennes, is indeterminable.

XI. *Trout from the lake Goukcha, near Erivan, Armenia.*

Pallas (Zoogr. Ross.-As. iii. p. 346) mentions a trout of that lake from notes made by Güldenstädt; he erroneously considers it to be identical with *S. hucho*.:—

D. 11. A. 10–11. Cæc. pyl. 70. Vert. 54.

Male entirely of a ferruginous tint, with a very indistinct silvery lustre on the sides, and with very few black spots, scarcely distinct except between the pectorals and ventrals; throat white. Female brown above and on the fins, below and on the sides white, variegated on the sides, as also on the opercles and dorsal fin, with round black spots, 3 lines in diameter, and placed far apart. Scales scarcely 1 line broad. Flesh red. Ova orange-coloured, $2\frac{1}{2}$ lines in diameter. Total length 1 foot 7 inches.

XII. *Trout from rivers of the Hindoo Koosh.*

Finally, Griffith (Calcutt. Journ. Nat. Hist. ii. p. 585, and iii. p. 283) mentions a trout found on the northern declivities of the Hindoo Koosh, and in the Bamean River, one of the tributaries of the Oxus, 11,000 feet above the level of the sea. This species appears to be the southernmost in Central Asia, and the nearest to the Indian region. There are no Salmonoids in Afghanistan or any of the countries to the south of the Hindoo Koosh. M'Clelland named this fish *Salmo orientalis*, which name cannot be retained, if the fish should prove to be a distinct species, as it was given to another fish by Pallas.

The notes added by M'Clelland allude to characters of the genus only; and the figure (pl. 1) is too rude to assist in the determination of the species.

XIII. *Northern Asia and North-western America.*

According to our present knowledge, we are obliged to unite the Salmonoids of Northern Asia and North-western America under one heading: although the greater number of species inhabiting western and central Siberia, or ascending Siberian rivers from the Arctic Ocean, will be found to be distinct from those of the Pacific or of the American fresh waters, yet there are several which evidently inhabit America as well as Asia; and others, described by Pallas and American writers under different names, may eventually prove to be identical.

Our knowledge of the Siberian fishes rests entirely on Pallas's researches; but we cannot expect that his descriptions, drawn up fifty years ago, should satisfy our requirements for distinguishing and recognizing the species of this most difficult family. What is more to be regretted is, that in his notes on the habits and geographical distribution of the species he did not confine himself to observations relating to the typical specimen of his description, but frequently mixes them with notes derived from other travellers and evidently taken from different species. Fortunately some of the typical specimens passed through Rudolphi into the Berlin Museum, where they are still preserved; and we are much indebted to Professor Peters, who allowed us to examine and to compare them with the American species in the British Museum and the Haslar Collection.

The Salmonoids of the Pacific coasts of North America have been worked out chiefly by Girard and Suckley; and the determination of the species described by the former is essentially facilitated by a series of illustrations. But the notes on the species named by the latter gentlemen are so incomplete, owing to the imperfect condition of the materials worked upon, as well as to the slight experience of the author in pointing out really specific characters, that all these specimens (many of which appear to be quite unfit for scientific examination) require a critical examination before the species founded

on them can be admitted into the system. Therefore, although for completeness' sake we have mentioned them in the following list, we have added only such parts of the original descriptions as may assist in recognizing the species.

33. Salmo purpuratus.

Salmo purpuratus, *Pall. Zoogr. Ross.-As.* iii. p. 374; *Cuv. & Val.* xxi. p. 358.
—— clarkii, *Richards. Faun. Bor.-Amer.* iii. p. 225.

Very closely allied to *S. fario*, but with more vertebræ.

B. 12. D. 13–14. A. 12–13. L. lat. 130. L. transv. 20/30. Cæc. pyl. 40. Vert. 63.

Form of the head and body as in *S. fario*. The posterior point of junction of operculum and suboperculum is nearly midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Lower limb of the præoperculum rather distinct. Snout obtuse; maxillary of moderate width; it extends scarcely to the vertical from the hind margin of the orbit in a specimen 9 inches long, and scarcely beyond it in one of 16 inches in length. Dentition rather feeble; vomerine teeth in a double series. Fins moderately developed; caudal fin emarginate in young specimens, subtruncate in specimens 9 inches long, in which the length of the middle caudal rays is contained once and three-fourths in that of the outer ones. There are thirteen scales in a transverse series descending from behind the adipose fin obliquely forwards to the lateral line. Head, body, dorsal and caudal fins covered with black specks.

Pacific coasts of Northern Asia and America.

a–b. Seven and nine inches long. British Columbia. Presented by J. K. Lord, Esq.

Besides these specimens, we have examined two of Pallas's typical specimens, flat skins, 14 and 16 inches long. Valenciennes regarded them as belonging to two different species; however, it is possible that they are merely male and female of the same fish. Pallas says of this species (which is evidently non-migratory):—

"This species, which migrates (*catanadroma*) from the North Pacific, usually enters the rivers Bolschaya and Bystraya and their tributaries, from the beginning of June to the end of September, not in troops but singly. Some also are said to remain all the year in the rivers and to return to the sea in the middle of May. On account of its voracity, it is always found very fat, so that, from the excellence of its white and firm flesh, it is to be recommended before all the other species; for it feeds incessantly during its ascent of the rivers, not only on the eggs of fish, small fish, Phryganeæ, Potamogetons, but also on the 'migratory mice' crossing the rivers. When from beneath the water it perceives a dwarf Sorbus with berries hanging over, it leaps out of the water with a great jerk and seizes the berries. Hence, unlike the other trout, which, during the ascent of the rivers,

grow lean from fasting, breeding, and exertion, this species is plump and well fed, and, with *S. callaris* only, does not perish in the winter." It does not much exceed a length of 18 inches.

The *Fario clarkii* (Girard, Proc. Acad. Nat. Sc. Philad. 1856, p. 219; and U. S. Pac. R. R. Exp. Fish. p. 314, pl. 71. figs. 5–8), named *Salmo masoni* by Suckley (Nat. Hist. Wash. Terr. p. 345), is some Salmonoid in the Parr-state, probably a young *Salmo purpuratus*.

34. Salmo stellatus.

Oregon Brook-Trout.

Fario stellatus, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 219; and *U. S. Pac. R. R. Exp. Fish.* p. 316, pl. 69. figs. 5–8; *Suckley, Nat. Hist. Wash. Terr.* p. 346, with the same figures.

B. 12. D. 12. A. 12. L. lat. 155. L. transv. 30/35. Cæc. pyl. 33. Vert. 59.

Similar to *S. purpuratus*, but with considerably smaller scales. The posterior point of junction of operculum and suboperculum is midway between the upper end of the gill-opening and the lower anterior angle of the suboperculum. Præoperculum broad, with the lower limb very indistinct. Snout of moderate extent; maxillary narrow and feeble, extending to the vertical from the hind margin of the orbit in specimens 7 inches long, and beyond it in older ones. Dentition moderately developed; vomerine teeth in a zigzag series, rarely placed in a pair. Caudal fin emarginate in young specimens, the middle rays being half as long as the outer ones, and truncate in adult ones. There are fifteen or sixteen scales in a series obliquely descending from behind the adipose fin to the lateral line. Head, and body, dorsal and caudal fins covered with black specks.

A non-migratory Trout from the fresh waters of British Columbia, and of the Oregon and Washington Territories.

a–d. Skins, from 12 to 14 inches long. Saumass Lake. From Mr. J. K. Lord's Collection.

e–f. Young, 7 inches long. River Skagit. From Mr. J. K. Lord's Collection.

35. Salmo penshinensis.

Salmo penshinensis, *Pall. Zoogr. Ross.-As.* iii. p. 381.

We have examined the typical specimen of this species; it is the skin of an adult male fish. As far as we can judge from this specimen, this species is very closely allied to *S. cambricus*: we cannot find any external distinctive characters; and if the two fish do not differ in the internal characters, we doubt not that they are specifically the same. According to Pallas this migratory Trout would ascend from the Bay of Penjinsk into the river Worofskaja.

Valenciennes has identified this species with *S. rossii*, Richards.: having the typical specimens of both fishes before us, we find that they are specifically, if not generically, quite distinct.

36. Salmo tsuppitch.

Salmo tsuppitch, *Richards. Faun. Bor.-Amer.* iii. p. 224; *Suckley in Nat. Hist. Wash. Terr.* p. 327.

Richardson gives the following characters:—

B. 13. D. 12. A. 13. [?Vert. 64.]

Back of body and head studded with oval and circular spots; sides and fins, including the caudal, destitute of spots; back mesially bluish grey, passing on the back of the head into blackish grey, and on the sides into yellowish grey with a greenish tinge and silvery white. General colour of the fins ashy grey. Jaws fully armed with minute sharp teeth; a single row on each palate-bone; a very few on the anterior end of the vomer, in a single series; and a double row on the tongue. Head small, exactly conical, terminating in a pointed snout. Commissure of mouth very slightly oblique. Convexity of dorsal profile rising gradually to origin of first dorsal, and declining thence to the tail. Caudal forked.

A migratory Trout from the Columbia River.

37. Salmo gairdnerii.

Salmo gairdnerii, *Richards. Faun. Bor.-Amer.* iii. p. 221.

The material on which this species has been founded was quite insufficient for that purpose, and the species for which this name has been intended is not likely to be ever recognized.

B. 11–12. P. 13. V. 11. A. 12. Vert. 64.

The only traces of variegated marking are a few faint spots at the root of the caudal. Tail terminating in a slightly semilunar outline. Vomer armed with a double row for two-thirds of its anterior portion. When the soft parts of the mandible are entirely removed, the projecting lower edge of the articular piece of the lower jaw is acutely serrated.

This fish ascends the river Columbia in the month of June in much smaller numbers than the Quinnat; its average weight is between six and seven pounds.

Girard adopted the name "*gairdnerii*" for a specimen from the Klamath river, Oregon Territory, which he describes and figures in Proc. Ac. Nat. Sc. Philad. 1856, p. 219, and U. S. Pac. R. R. Exp. Fish. p. 313, pl. 71. figs. 1–4. There is nothing whatever to indicate that this identification is correct; on the contrary, it would appear that Dr. Gairdner's fish had a double series of vomerine teeth, whilst Girard referred his fish to *Fario* (Valenc.). However, we may mention that this gentleman is most inaccurate in his description of the teeth of Salmonoids. A few years later (Proc. Ac. Nat. Sc. Philad. 1858, p. 224) he recognized the discrepancies between his and Richardson's descriptions, naming his specimens *Fario newberrii*. If the figure given by him is correct, and the scales are as small as represented, we may presume that the typical specimen of this *F. gairdnerii* (Girard) is a young female of *Salmo stellatus*.

Scarcely less doubtful is the *S. gairdnerii*, Suckley (Nat. Hist. Wash. Terr. p. 331), noticed from two dried skins so much shrivelled that they are evidently quite unfit for a scientific description.

38. Salmo aurora.

Fario aurora, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 218; and *U. S. Pacif. R. R. Exp. Fish.* p. 308, pl. 68.

B. 11. D. 12. A. 13.

The length of the head is one-fourth of the total (without caudal). Maxillary extending beyond the orbit in a specimen 11 inches long. Anterior margin of dorsal fin equidistant between the tip of the snout and the base of the caudal. Caudal rather conspicuously emarginate. Greyish silvery above; sides and belly yellowish orange; dorsal fin spotted (Girard).

Astoria, Oregon Territory.

39. Salmo gibbsii.

Fario tsuppitch, *Girard in Proc. Acad. Nat. Sc. Philad.* viii. 1856, p. 218, and in *U. S. Pacif. R. R. Exp. Fish.* p. 310, pl. 69 (not *Richards.*).

Salmo gibbsii, *Suckley, Ann. Lyc. Nat. Hist. N. York*, vii. 1858, p. 1.

B. 12–13. D. 13. A. 14.

Body elongated, compressed, fusiform in profile; dorsal profile but slightly arched; snout rounded, the jaws subequal; maxillary gently curved, dilated posteriorly, and extending to a vertical line passing slightly behind the orbit; anterior margin of dorsal nearer the extremity of the snout than to the insertion of caudal fin; colours of the head and back, in fresh specimens, rich dark olive-green, profusely dotted with roundish black spots, the scales in certain lights showing bright silvery reflection; the sides below the lateral line are usually unicolor, of a yellowish white; inferior fins unspotted; tail and upper fins yellowish olive, profusely spotted with round and oval spots of black, each spot being from one to two lines in diameter, and completely isolated from the others, not confluent as in some other species; caudal moderately lunated, not forked; head small; teeth small, and very numerous, especially the labials.

Known from a single skin only, which appears to be much stretched; it is a female. Columbia River; believed to be non-migratory.

40. Salmo irideus.

Salmo iridea, *Gibbons, Proc. Cal. Ac. Nat. Sc.* 1855, p. 36.

—— rivularis, *Ayres, ibid.* p. 43.

Salar iridea, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 220; and *U. S. Pac. R. R. Exp. Fish.* p. 321, pl. 73. f. 5, and pl. 74.

B. 10. D. 14. A. 14. L. lat. 140.

Body rather stout, head of moderate size; maxillary extending beyond the vertical from the hind margin of the orbit in specimens

10 inches long. *Caudal deeply emarginate.* Body, dorsal and caudal fins with numerous small black spots.

A non-migratory species of rivers of Upper California.

41. Salmo kennerlyi.

Salmo kennerlyi, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 307.

Tail strongly forked, its free margin somewhat waved. Snout somewhat turned up, the lower jaw projecting slightly beyond the upper. A single row of teeth along the anterior half of the vomer; teeth on the premaxillaries rather strong. Size of adult rarely exceeding 10 or 11 inches. General colour of body red, dingy along the back, paler on the sides, and fading into pure white on the belly. Small irregular black spots above the lateral line. Pectorals bluish, their tips slightly greyish. Dorsal and ventrals red. Tail spotted.

Chiloweyuk Lake, near Fraser River. Ne-hoi-al-pit-kwu River.

Mr. Gill (Proc. Acad. Nat. Sc. Philad. 1862, p. 330) proposes a (hybrid) generic name for this fish, *Hypsifario*, this genus being distinguished by its "compressed body, projecting snout, &c."

42. Salmo warreni.

Salmo warreni, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 308.

Dorsal outline strongly arched; its convexity rising suddenly from the nape, and attaining its height at a point near a line drawn perpendicular to the lateral line and touching the tips of the pectorals when flattened backwards along the sides. Head rather broad; muzzle somewhat conical; jaws equal and rounded. The eyes beneath plane of lateral line. Opercles and preopercles spotted with minute spots of black. Numerous stellate and irregular black spots, many of which are quite faint as if obscured by the thickness of the overlying scales; belly white; back bluish or greenish; dorsal fin and tail spotted. Scales small (but much larger than in *S. fontinalis*), compact and very adherent; when glistening, in certain reflections giving an enamelled appearance to the fish. Tail forked.

Chiloweyuk Depot. Waters of Fraser River, British Columbia.

The largest specimens examined by the describer were not over 10 inches in length. They may have been immature individuals of a larger anadromous species.

43. Salmo brevicauda.

Salmo brevicauda, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 308.

Body long and slender, its dorsal outline from a point opposite the posterior margin of the opercula being nearly straight. Scales large, quite thin, and glistening with metallic lustre, very loosely adherent; they encroach upon the tail for nearly a third of its length,

thus giving it a short appearance. The peduncle of the tail is wide for the depth of the body, and the caudal itself is somewhat short and narrow. Head long, but not deep. Dorsal and caudal fins freely spotted with oval black spots. Body marked with small stellate and irregular dark spots, their number and size varying greatly in different individuals. There are usually two rows of teeth on the vomer. The head is contained nearly five times in the total length, which rarely exceeds 18 or 20 inches.

Obtained from the waters of Puget Sound and the streams in that vicinity.

44. Salmo bairdii.

Salmo bairdii, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 309.

Snout having a deep notch between the extremities of the premaxillaries, receiving a conical fleshy protuberance projecting upwards from the chin. Teeth strong, hooked, and very uniform in size, from two to four on the front of the vomer, none on its shaft [in one of the specimens examined, a single accidental small tooth was found on the shaft of this bone; in the other, none]. Tail broad, and but moderately lunated. Scales small. Anterior rays of the pectorals, ventrals, and anal broad, and the skin of them yellowish red, being coloured differently from the rest of the fin, as in *S. fontinalis*. Attains a weight of ten or twelve pounds.

Clarke's Fork of the Columbia, and its tributaries.

45. Salmo parkii.

Salmo parkei, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 309.

Head contained about four and a half times in the total length; its top flat; muzzle pointed. Tail forked, unspotted. Back dark green, spotted with lighter green; sides spotted with red. Scales adherent and about the size of those of *S. bairdii*. A disposition towards the formation of a fleshy "tit" projecting upwards at the point of lower jaws, with a corresponding notch between the premaxillaries. The maxillary reaches to a point considerably behind the eye. Branchiostegals 13–14. The anterior rays of the lower fins are covered with a differently coloured skin from that of the rest of the fin, as in *S. fontinalis* and *S. bairdii*. Two teeth on the outer extremity of the vomer, behind which from one to three on the shaft.

Kootenay River, Rocky Mountains.

46. Salmo richardi.

Salmo richardii, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 311.

Female. Head conical; jaws apparently equal, the thick fleshy tip on the point of the lower jaw of the fresh-run fish aiding much to give this appearance. The maxillary extends back to a point immediately below the posterior margin of the orbit. Teeth small, and

but few. Tail deeply lunated, almost forked. Caudal and other fins unspotted. Does not often attain a greater weight than fifteen pounds. Branched rays usually fourteen.

North-west Pacific coast. Enters Fraser's and Skagit Rivers.

47. Salmo truncatus.

Salmo truncatus, *Suckley, Ann. Lyc. Nat. Hist. N. York*, vii. 1858, p. 3.

Body fusiform; dorsal profile moderately arched; anterior margin of dorsal fin much anterior to a point equidistant between the nose and the insertion of the tail; head small, one-thirteenth of the total length. Teeth small, those of the vomer in a double series. Tail small, its free margin, when extended, being almost straight, having a very faint tendency to lunation. Scales generally large. Colours of the fresh-run fish:—back of head, back, dorsal and caudal fins bright blue, spotted on the head with roundish, on the fins with oval spots of black; the blue of the back is silvery, that of the head and fins darker; lower parts silvery white, this colour extending about an inch above the lateral line, and merging itself irregularly into the colour of the back; no spots below the lateral line, which is faint and of a bluish dusky colour; lower fins pale and unspotted, their tips somewhat darkish.

An adult female from the Straits of Fuca.

XIV. *Japan.*

Some Salmonoids from Japan are described by J. C. Brevoort in 'Narrat. Exped. Amer. Squadr. to China and Japan,' vol. ii.; the materials used by this gentleman are some coloured ("spirited") drawings executed by artists who had not the slightest acquaintance with ichthyology. Thus, although their value is doubtful even for those who will have specimens to compare with them, and although they are absolutely useless without such specimens, yet Mr. J. C. Brevoort has recognized one new, and two Pallasian species in them! viz.:—

1. *Salmo perryi*, Brevoort, p. 273, pl. 9. fig. 1.
2. —— *orientalis*, Pall. p. 275, pl. 9. fig. 2 (*S. masou*).
3. —— *leucomœnis*, Pall. p. 276, pl. 10. fig. 3.
4. —— sp.? Young, p. 277, pl. 10. fig. 1.

All are said to be from Hakodadi.

XV. *Rivers of the eastern slope of the Rocky Mountains.*

48. Salmo lewisii.

Salar lewisii, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 210, and *U. S. Pacif. R. R. Exp. Fish.* p. 318, pl. 72.

B. 12. D. 11. A. 11.

Vomerine teeth in a double series. Body rather thick in the middle region; head moderate. Posterior extremity of the max-

illary reaching a vertical line drawn immediately behind the orbit. Anterior margin of dorsal fin a little nearer the extremity of the snout than the base of the caudal fin. Body, dorsal, adipose, and caudal fins dotted with black. Caudal emarginate. (*Girard.*)

A non-migratory Trout from the Missouri; the specimens from 12 to 13 inches long were taken just below the falls of that river.

49. Salmo virginalis.

Salar virginalis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 220; and *U. S. Pacif. R. R. Exp. Fish.* p. 320, pl. 73. figs. 1–4.

A non-migratory Trout, from Utah Creek, upper waters of the Rio Grande del Norte, which appears to be very similar to *S. fario*; the description does not contain any distinctive characters.

50. Salmo namaycush.

Salmo namaycush, *Penn. Arct. Zool.* ii. p. 139; *Introd.* p. 141; *Richards. Faun. Bor.-Amer.* iii. p. 179, pl. 79 & pl. 85. fig. 1; *Kirtland, Rep. Zool. Ohio*, p. 195, and *Bost. Journ. Nat. Hist.* 1842, iv. p. 25, pl. 3. fig. 2; *Agass. Lake Super.* p. 331.

—— amethystinus, *Mitch. Journ. Acad. Nat. Sc. Philad.* 1818, i. p. 410; *Dekay, New York Faun. Fish.* p. 240, pl. 76. fig. 241 (*Richards.* cop.); *Storer, Synops.* p. 193.

Salar namaycush, *Cuv. & Val.* xxi. p. 348.

B. 11–12. D. 13–14. A. 12. V. 9. L. lat. 220.

Body rather stout, head very large, about two-sevenths of the total length (without caudal); bones of the head firm and strong. Præoperculum very short, without lower limb; suboperculum very broad, two-thirds as broad as long; the posterior point of junction of operculum and suboperculum is much nearer to the upper end of the gill-opening than to the lower anterior angle of the suboperculum. Maxillary strong, but narrow, with the supplementary bone much projecting beyond its hinder extremity; it extends far beyond the hind margin of the orbit in old examples. Jaws equal or subequal in length. Teeth strong, those on the vomer persistent throughout the life of the fish, and in a single series*. Fins well developed; caudal fin deeply forked, the outer rays being nearly thrice as long as the inner ones.

Inhabits all the great lakes between the United States and the Arctic Sea—non-migratory.

The above characters are taken from the specimen described and figured by Richardson.

Salmo confinis, Dekay, New York Fauna, Fish. p. 239, pl. 38. fig. 123, would appear to differ from *S. namaycush* in having the caudal fin much less emarginate; this, however, requires confirmation. This fish is said to be the "well-known" Lake-Salmon or Salmon Trout of the State of New York.

* Richardson describes the vomerine teeth as disposed in a double series, probably thinking that one-half of the vomer had been cut away. But this is not the case, and those teeth form a single series only.

51. Salmo siscowet.

Fario erythrogaster, *Cuv. & Val.* xxi. p. 308 (not *Dekay*).
Salmo siscowet, *Agass. Lake Super.* p. 333, pl. 1. fig. 3.

B. 12. D. 13–14. A. 12–13. L. lat. 200.

Similar in habit to *S. umbla*; head of moderate size, one-fourth or rather less than one-fourth of the total length (without caudal); præoperculum very short, without lower limb; suboperculum broad; the posterior point of junction of operculum and suboperculum is nearer to the lower anterior angle of the suboperculum than to the upper end of the gill-opening. Maxillary strong, narrow, extending a little behind the hind margin of the orbit in a specimen 16 inches long. Jaws equal in length. Teeth rather strong; those on the vomer form a short series, double anteriorly and simple posteriorly. Fins rather small; caudal deeply forked, the outer rays not being quite thrice as long as the inner ones. Greenish on the back, reddish on the sides, shining silvery, with numerous small round reddish-white spots; dorsal fin obscurely spotted.

Great Lakes of North America—non-migratory.

a. Skin 16 inches long. Lake Ontario, eight miles below the falls of Niagara. From Dr. Parnell's Collection.

?*b*. Dried head of a large specimen. Collected by Captain Back.

The description of a *Salmo symmetrica* from the river Winnipisseogee in New Hampshire (Prescott, Amer. Journ. 1851, xi. p. 340) is drawn up by an author who has taken Dekay as his guide; it is therefore perfectly valueless.

XVI. *Salmonoids from Greenland, mentioned by Fabricius.*

Fabricius, Faun. Grönl. p. 170, *et seq.* mentions several Salmonoids belonging to the genus *Salmo*; but without a reexamination of Greenland specimens it is impossible to recognize the characters of these species, a difficulty already experienced by Sir J. Richardson, Faun. Bor.-Amer. iii. p. 178. Fabricius mentions:—

1. *Salmo salar*, very rare, and not seen by Fabricius.
2. *Salmo carpio*, a migratory Trout, which, of course, is not the *S. carpio*, L.
3. *Salmo alpinus*, also a migratory Trout, probably specifically different from the preceding.
4. *Salmo stagnalis*, a Charr, very probably identical with *S. alipes*, Richards.
5. *Salmo rivalis*, probably a compound of the young of various species.

Finally, *Storer* describes, in a very superficial manner, a Salmonoid from Labrador. No mention is made of the arrangement of the vomerine teeth; so that only the coloration induces us to place it in this division, and not among the Charrs:—

52. Salmo immaculatus.

Storer, *Bost. Journ. Nat. Hist.* 1850, vi. p. 264.

D. 9. A. 11. V. 9.

Length of head about one-sixth of the length of body; depth of head two-thirds of its length; greatest depth of body, directly in front of dorsal fin, equal to length of head. Upper jaw the longer. Jaws with numerous sharp incurved teeth. Eyes laterally elongated; their diameter one-third the distance between them. Opercles rounded posteriorly; lower portion of operculum naked, marked with concentric striæ; præoperculum larger than in *S. fontinalis*.

Scales larger than those of *S. fontinalis*.

The dorsal fin commences just anterior to the median line; it is nearly quadrangular. Adipose fin situated at a distance back of the first dorsal little less than one-half of the length of the fish.

Pectorals beneath posterior angle of operculum; their length three-fifths of that of the head. Ventrals beneath posterior portion of first dorsal; the scales at their base very large.

The anal is situated at a distance back of the ventrals equal to length of head, and terminates directly beneath the adipose fin; caudal deeply forked; its length equal to depth of body.

Silvery on sides and abdomen; darker on back. No spots.

Only a single specimen, thirteen inches and a half long, of this fish taken, and that by a gill-net stretched across the mouth of a brook flowing into Red Bay, Labrador.

Second subgeneric group. SALVELINI.

Salvelini, *Nilss. Skand. Faun. Fisk.* p. 368.
Salmo, sp., *Cuv. & Val.*

Teeth on the head of the vomer only from the earliest age of the individuals.

Most of these fishes, viz. the Charr proper, have a series of teeth along the median line of the hyoid bone: Rapp has proposed for them the generic name of *Umbla* (Fische des Bodensee's, p. 35). Others, like *S. hucho*, lack these teeth, and may be united under the name of *Hucho*. Probably some of the species described by Pallas should be referred to this latter group. However, as the dentition of these fishes is very imperfectly known, this division can be merely indicated at present.

I. *Europe.*

1. Salmo umbla.

Ombre chevalier; *Röthel.*
Salmo Lemani lacus, seu Umbla, *Rondel.* ii. p. 160.
Salmo no. 7, *Artedi, Synon.* p. 25; and no. 9, *Genera*, p. 13.
Salmo umbla, *L. Syst. Nat.* p. 511; *Bl., Jurine, Poiss. du Lac Leman*, pl. 5; *Agass. Poiss. d'eau douce*, pls. 10 & 11; *Cuv. & Val.* xxi. p. 233; *Heckel, Reisebericht, in Sitzgsber. Akad. Wiss. Wien*, 1851, July, p. 93; *Rapp, Fische d. Bodensee's*, p. 32, taf. 5 (fig. optima);

Heck. und Kner, Süsswasserf. p. 285; *Günth. Proc. Zool. Soc.* 1862, p. 39.

Salmo salvelinus, part., *Siebold, Süsswasserf.* p. 280.

D. 12. A. 12–13. P. 14. V. 9. L. lat. 200. Vert. 65. Cæc. pyl. 36.

Body slightly compressed, deeper than broad, its greatest depth being equal to the length of the head, and two-ninths of the total length (to the end of the middle caudal rays). The length of the head is a little more than one-half of the distance between the snout and the vertical from the origin of the dorsal fin. The maxillary extends beyond the hind margin of the orbit in adult fishes (and is singularly straight, narrow, of nearly equal width in its entire length, styliform, in the specimens examined). Teeth rather strong. The diameter of the eye is more than, or scarcely equal to, half the width of the interorbital space. Fins well developed; the pectoral fin terminates at a distance from the vertical from the origin of the dorsal fin, but is equal to, or even more than, one-half of the distance of its root from the ventral*. Lower parts whitish, or but slightly tinged with red.

Lakes of Constance, Neuchâtel, and Geneva.

a. Adult: stuffed. Lake of Geneva. From Mr. Yarrell's Collection.

b. Half-grown. Switzerland. From Prof. L. Agassiz's Collection.

c, d. Adult. Lake of Constance.

2. Salmo salvelinus.

Sälbling.

Salvelin, *Willughby*, p. 195.

Umbla, *Marsil. Danub. Pan.-Mys.* iv. tab. 28 & 29.

Salmo no. 10, *Artedi, Gen.* p. 13; and no. 11, *Synon.* p. 26.

Salmo salvelinus, *L. Syst. Nat.* p. 511; *Bloch, Fische Deutschl.* taf. 99; *Meidinger, Ic. Pisc. Austr.* tab. 22; *Cuv. & Val.* xxi. p. 246; *Heckel, Reisebericht, in Sitzgsber. Akad. Wiss. Wien*, 1851, July, p. 89; *Heck. & Kner, Süsswasserf.* p. 280; *Günth. Proc. Zool. Soc.* 1862, p. 38; *Siebold, Süsswasserf.* p. 280 (part.).

—— alpinus, *Meidinger, l. c.* tab. 19.

? Salmo salvelinus, *Nilss. Skand. Faun. Fisk.* p. 422; *Günth. Proc. Zool. Soc.* 1863, p. 7.

Salmo umbla, *Agass. Poiss. d'eau douce*, pl. 9.

—— distichus, *Heckel, l. c.*

—— monostichus, *Heckel, l. c.*; *Rapp, Fische des Bodensee's*, p. 35.

D. 12–13. A. 13. P. 13. V. 9. L. lat. 220. Vert. 64. Cæc. pyl. 36.

Body elongate, nearly as broad as deep, its greatest depth being two-elevenths of the total length (to the extremity of the middle caudal rays); the length of the head is two-ninths or one-sixth of the total. The maxillary is considerably broader in and behind its middle than near its base. Teeth rather feeble. The diameter of

* So it is in our specimens and in the figure given by Heckel, but it is shorter in the figure given by Rapp.

the eye is less than one-half of the width of the interorbital space. Fins moderately developed: the pectoral fin terminates at a great distance from the vertical from the origin of the dorsal, and its length is less than one-half of the distance of its root from the ventral. Lower parts deep orange-coloured during the spawning-season, and the lower fins with white anterior margins.

Alpine Lakes of Bavaria and Austria.

a–b, c–e. Young. Tegern Lake. From Dr. Gemminger's Collection. Vert. 64.

f. Seventeen inches long. Lake Wetter. Presented by Prof. Lilljeborg. Vert. 65; Cæc. pyl. 48.

The specific characters of this species are not yet sufficiently pointed out, and it is possible that it is identical with *S. umbla*; indeed both are united by Siebold, whilst Rapp and Heckel do not hesitate to regard them as distinct. None of the authors mentioned has paid any attention to the number of the vertebræ in specimens of the Sälbling. With the materials in our collection we are not enabled to arrive at a decided opinion. The specimens from the Tegern Lake are very young, and we are not certain whether they should not be referred to *S. umbla*; and as regards the specimens from Lake Wetter, a direct comparison with the true Sälbling may show that it is a distinct species altogether, differing from it by having the body more elevated, and the scales larger (190 transverse series).

3. Salmo alpinus.

Salmo no. 8, *Artedi, Genera*, p. 13 (not synon.).

Salmo alpinus, *L. Faun. Suec.* p. 117. no. 310; and *Syst. Nat.* i. p. 510; *Nilss. Skand. Faun. Fisk.* p. 426; *Jardine, Report of the Fourth Meeting of the Brit. Assoc. Edinb.* p. 614; *Günth. Proc. Zool. Soc.* 1863, p. 8.

—— umbla, *Parnell, Fish. Firth of Forth*, p. 148; *Thompson, Ann. & Mag. Nat. Hist.* 1840, vi. p. 439 (part.).

Charr, *Yarrell, Brit. Fish.* 3rd edit. p. 241 (descr. part. and fig. p. 241).

D. 13. A. 12. P. 13. V. 10. L. lat. 195–200. Vert. 59–62. Cæc. pyl. 36–42.

Body slightly compressed and elongate, its greatest depth being one-fifth or one-sixth of the total length (to the end of the middle caudal rays). The length of the head equals the height of the body in mature specimens, but is somewhat more in immature; it is two-ninths or one-fifth of the total; it is rather less than, or equal to, one-half of the distance between the snout and the vertical from the origin of the dorsal fin. The maxillary extends but little beyond the orbit in the fully adult fish. The eye is one-half, or rather less than one-half, of the width of the interorbital space. The length of the pectoral of the mature fish is more than one-half of the distance of its base from the root of the ventral; in immature specimens its length is considerably less. The length of the longest ray of the dorsal is much less than that of the pectoral, and three-fifths or one-half of the length of the head; the length of its last ray is a

little more than one-half or two-thirds of the length of its base. Teeth of moderate size.

Scandinavian peninsula. Scotland. ? Iceland.

a–e. From 13 to 17 inches long. Lapland. From Mr. Wheelwright's Collection. Vert. 62.

f–h. From 10 to 11 inches long. Gefle. From Mr. Wheelwright's Collection. Vert. 60; Cæc. pyl. 42.

i. Ten inches long. Gestrickland. From Mr. Wheelwright's Collection. Vert. 62; Cæc. pyl. 36.

k. Ten inches long. Sweden. Presented by Prof. Lilljeborg. Vert. 62.

l–m. Nine inches long (immature). Helier Lake, Hoy Island (Orkneys). Presented by Dr. Trail. Vert. 59; Cæc. pyl. 36. Average length of mature fish, 12 or 14 inches.

n–o. Eight inches long. Sutherlandshire. Presented by W. Peel, Esq.

p. Young. Loch Roy, Invernesshire. Presented by H. C. Pennell, Esq.

q–r, s–u. From 9 to 11 inches long (mature). Scotland. Purchased of Mr. Stevens.

v, w–z. Young. Scotland. From Mr. Yarrell's Collection.

α, β. Adult: stuffed. Scotland. From Mr. Parnell's Collection.

γ. ?Adult: skin. From Mr. Yarrell's Collection.

δ–e. Fourteen inches long. Lake Myvatn, Iceland. Presented by G. G. Fowler, Esq.* Vert. 61.

Valenciennes (Cuv. & Val. xxi. p. 249) appears to have described a distinct species under the name of *S. alpinus*; he attributes to it sixty-seven vertebræ.

In a male specimen, from Quickjock, nearly fourteen inches long, the head and body are compressed, and but slightly elevated; the greatest depth of the body is below the origin of the dorsal fin, where it is *one-fifth* of the total length (to the end of the middle caudal rays). The least depth of the tail is rather less than the length of the base of the dorsal fin. The height of the head above the mandibulary joint equals the distance between the posterior margin of the orbit and the end of the operculum. The top of the profile of the head is somewhat elevated above the margin of the orbit, the diameter of which is nearly one-sixth of the length of the head, two-thirds of the extent of the snout, and rather less than one-half of the width of the interorbital space; the latter is convex, with a rather prominent ridge along the middle, and with a pair of series of pores. Snout compressed, conical, with the jaws equal anteriorly. The *maxillary* extends to the vertical from the hind margin of the orbit; in the two largest specimens (15–17 inches

* Unfortunately the intestines of these specimens have been removed; externally they agree perfectly with our other specimens of *S. alpinus*. Mr. Fowler informs me that the water of Lake Myvatn is in parts warm all the year round, and the natives assert that the Charr are quite different from those found in any other lake in the country.

long) it reaches slightly beyond that vertical. It is armed with 20–22 *teeth* of moderate size; six teeth in each intermaxillary, fifteen in each mandible; three pairs on the vomer, arranged in two longitudinal series slightly converging behind; nineteen on each palatine bone, and six pairs on the tongue. *Operculum* obtusely rounded behind, its length being two-thirds of its height; the subopereulum projects but little beyond the hind margin of the opercle, its vertical width being one-half of that of the operculum.

The origin of the dorsal fin is a little nearer to the end of the snout than to the root of the caudal; *the length of its base is one-third more than that of its last ray, and contained once and a quarter in that of the fourth ray.* The fifth and sixth rays form an acute point, and the upper margin of the fin is straight. The first ray is rudimentary, the second half the length of the third, the third two-fifths the length of the fourth, the fifth simple, the sixth branched, the last split to the base. The distance of the adipose fin from the dorsal is but little more than twice the base of the latter.

The origin of the anal fin is exactly in the middle between the root of the caudal and that of the outer ventral ray; the length of its base is somewhat less than that of the dorsal, and is contained once and a quarter in the length of the fifth ray.

Caudal fin forked, one of the middle rays being two-fifths as long as the outer ones, the length of which is contained six times and a half in the total; lobes pointed.

The base of the pectoral is entirely free, and not overlapped by the gill-cover apparatus; *it terminates at a considerable distance from the vertical from the origin of the dorsal,* equals the length of the head without snout, *and is contained once and one-third in the distance between its root and that of the ventral.*

The ventral is inserted below the middle of the dorsal.

A specimen, 12 inches long, from the same locality, agrees very well with the one first described; its operculum, however, is as long as high, and the length of the pectoral fin equals nearly one-half of the distance between its root and that of the ventral.

An immature specimen, 10 inches long, differs widely from the preceding, its body and its head being much more elongate. The length of the head is more than the height of the body, the former being one-fifth, the latter one-sixth of the total length; the operculum is longer than high, and the height of the head above the mandibulary joint is less than the distance between the posterior margin of the orbit and the end of the operculum; the maxillary extends nearly to the vertical from the hind margin of the orbit. The length of the pectoral fin is considerably less than one-half of the distance between its root and that of the ventral.

With regard to the coloration, this species does not differ from *S. willughbii*; the immature specimen has the sides silvery, and the red of the lower parts is replaced by a slight tinge of orange-colour.

The largest of our *Scotch* specimens is a mature male 11 inches long. It differs from the male from Quickjock in having a more leongate body, the depth of which is one-sixth of the total length.

The operculum is as high as long; the pectoral fin terminates at a considerable distance from the vertical from the origin of the dorsal, equals the length of the head without snout, and is contained once and a quarter in the distance between its root and that of the ventral. The *females* do not differ from the males. The *immature specimens* have the same short pectorals which we have found in the young Lap Charr; but the operculum is much less elongate.

4. Salmo nivalis.

Salmo alpinus (nivalis), *Faber, Fische Islands*, p. 169.
—— rivalis, *Gaimard, Voy. Isl. et Groenl.* pl. 15 (not good).
—— nivalis, *Günth. Proc. Zool. Soc.* 1863, p. 12, pl. 1 (young).

D. 14. A. 13. L. lat. 190. Vert. 62. Cæc. pyl. 41.

Body slightly compressed and elongate; its greatest depth equals the length of the head, and is one-fifth, or somewhat less than one-fifth, of the total length; the length of the head is rather more than one-half of the distance between the snout and the vertical from the origin of the dorsal fin. The maxillary extends beyond the orbit in the adult fish (15–20 inches long); the eye is less than one-half of the interorbital space in the adult fish. The length of the pectoral fin is, in mature and immature specimens, more or much more than one-half of the distance of its base from the root of the ventral. The length of the longest dorsal ray equals that of the pectoral, or that of the head without snout; the length of the last ray is two-thirds of the length of the base. Teeth rather small. Lower parts of a deep orange-colour; lower fins with the anterior margin white or light orange-coloured.

Iceland, inhabiting rivers as well as lakes.

a–d. From 10 to 21 inches long; had been smoked. Iceland. Presented by Mr. Bartlett.

e–f. Eleven inches long. Iceland. Presented by G. G. Fowler, Esq.

5. Salmo killinensis.

Günth. Proc. Zool. Soc. 1865, p. 699, pl. 40.

D. 14–15. A. 13. P. 13. V. 9. L. lat. 180. Vert. 62. Cæc. pyl. 44–52.

Head and body thick, but slightly compressed; the greatest depth of the body equals the length of the head, and is two-ninths of the total length (to the extremity of the central caudal ray); the length of the head is a little more than one-half of the distance between the snout and the vertical from the origin of the dorsal fin. The lower jaw is rather shorter than the upper, and the maxillary extends scarcely beyond the hind margin of the orbit in adult males. Teeth very small. Snout obtuse; eye of moderate size, much shorter than the snout, and about half the width of the interorbital space. Suboperculum very short and high. Fins excessively developed; pectoral not much shorter than the head. Dorsal long and high, the longest ray being nearly as long as the head (without snout), or shorter than

the pectoral fin; the length of the last ray is two-thirds of the length of the base. The ventral fin extends nearly to the vent; caudal very broad, slightly emarginate.

Head, upper parts, and fins brownish-black; lower parts with an orange-coloured tinge in the male; sides with very small, light, inconspicuous spots. Anterior margins of the lower fins white or light orange-coloured.

Loch Killin, Inverness-shire.

a–f. Adult, from 10 to 15 inches long. Presented by J. Gould, Esq. Obtained in October.

g. Adult: stuffed. From Mr. Yarrell's Collection.

6. Salmo willughbii.

The Charr of Windermere.

Charr, *Willughby, Hist. Pisc.* p. 196; *Penn. Brit. Zool.* iii. p. 267, or (edit. 1812) iii. p. 407 (part.); *Yarrell, Brit. Fish.* 3rd edit. p. 241 (part.).

Salmo alpinus, *Donov. Brit. Fish.* pl. 61; *Turton, Brit. Faun.* p. 104.

Salmo umbla, *Thompson, Ann. & Mag. Nat. Hist.* 1840, vi. p. 439 (part.).

Salmo willughbii, *Günth. Proc. Zool. Soc.* 1862, p. 46, pl. 5, and 1863, p. 11.

D. 12–13. A. 12. P. 13–14. V. 9–10. L. lat. 165.
Vert. 59–62. Cæc. pyl. 32–44.

Body compressed, slightly elevated, its greatest depth being one-fourth of the distance of the snout from the end of the middle caudal rays; the length of the head is a little more than one-half of the distance between the snout and the vertical from the origin of the dorsal. Head compressed; interorbital space convex, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; teeth of moderate strength, four in each intermaxillary, twenty in each maxillary. Length of the pectoral less than that of the head, much more than one-half of the distance between its root and that of the ventral. The height of the dorsal fin equals the length of the head (without snout). Sides with red dots; belly red; pectoral, ventral, and anal with white margins.

Lake of Windermere; Loch Bruiach (Scotland).

a–b. Eleven inches long. Windermere. Presented by Sir J. Richardson.—Types of the species. Vert. 59; cæc. pyl. 32–35.

c. Ten inches long: stuffed. Cumberland.

d. Young: skin, in bad state. Cumberland. From Mr. Yarrell's Collection.

e. Several specimens, from 7 to 8 inches long. Loch Bruiach. Presented by Lord Lovat.—Vert. 61–62; cæc. pyl. 39–44.

Description of a Male specimen (spec. *a*).

Head and body compressed, slightly elevated; its greatest depth, which is below the origin of the dorsal fin, is contained four times in the total length (to the end of the middle caudal rays). The least

depth of the tail equals the length of the base of the dorsal fin. The height of the head above the mandibulary joint equals the distance between the posterior margin of the orbit and the end of the operculum. The upper profile of the head is somewhat elevated above the margin of the orbit, the diameter of which is nearly one-fifth of the length of the head, shorter than the snout, and more than one-half of the width of the interorbital space; the latter is very distinctly convex, with a rather prominent ridge along the middle, and with a pair of series of pores. Snout slightly compressed, subconical, with the jaws equal anteriorly. The *nostrils* are situated immediately before the eye; the posterior is the wider, and the cutaneous bridge between the two is not developed into a flap. The *maxillary* extends scarcely beyond the vertical from the posterior margin of the eye, and is armed with 20–21 *teeth* of moderate size; four teeth in the intermaxillary, seventeen in each mandible, two pairs on the vomer, fifteen on each palatine bone, and four pairs on the tongue. The *subopercŭlum* forms the hindmost part of the gill-cover, and does not cover the exposed portion of the humerus above the root of the pectoral; its vertical width is rather less than one-half of that of the operculum, and therefore is comparatively narrow. Nearly all the *branchiostegals* are situated at the side of the head, and exposed in a lateral view of the fish. The lower branch of the outer *branchial arch* is provided with eleven lanceolate, slightly curved gill-rakers; the longest is less than two lines long in the specimen described.

The origin of the dorsal fin is exactly in the middle between the snout and the root of the caudal; the length of its base is equal to the length of the last ray, and contained once and three-fourths in that of the fourth; the fourth and fifth rays form an acute point, and the upper margin of the fin is straight; the first ray is rudimentary, the second half as long as the third, the third three-fifths of the fourth, the fourth simple, the fifth branched, fourth and fifth longest, the last split to the base. The distance of the adipose fin from the dorsal is equal to twice and a third the base of the latter.

The origin of the anal fin is exactly in the middle between the root of the caudal and that of the outer ventral ray; the length of its base equals that of the dorsal, and is contained once and two-thirds in the length of the fifth ray. The five anterior rays are enveloped in a common membrane, so that their length can be ascertained only by dissection; the fourth and fifth rays are the longest, and form an acute point; the lower margin of the fin is nearly straight. The first ray is rudimentary, the second half as long as the third, the third three-fourths of the fourth, the fourth simple, the fifth branched; the last split to the base, its length being two-fifths of that of the fourth.

Caudal fin forked, one of the middle rays being half as long as the outer ones, the length of which is contained five times and a half in the total. Lobes pointed.

The base of the pectoral is entirely free, and not overlapped by the gill-cover apparatus. It does not extend to the vertical from the

origin of the dorsal, is rather shorter than the head, and at least two-thirds of the distance between its root and that of the ventral.

The ventral is inserted below the two last dorsal rays, its length being two-thirds of that of the pectoral, or of the distance between the root of its outer ray and the vent.

The scales are very thin and small; one taken from between the dorsal and the lateral line is ovate, two-thirds as high as long. In order to ascertain the number of transverse series of scales, it is necessary to count those above the lateral line, and not the perforated scales of the lateral line, which are larger than the others and do not correspond to the transverse series. The scales on the back are minute, rudimentary, hidden in the skin.

The colour on the sides of the back is a dark sea-green, passing into blackish on the back, on the greater part of the dorsal, and caudal. Sides with a slight silvery shade, passing into a beautiful deep red on the belly. Pectoral greenish, passing into reddish posteriorly, the upper margin being white; ventral red, with white outer margin, and with a blackish shade within the margin; anal reddish, with a blackish shade over the whole of the middle, and with white anterior margin; sides of the head silvery, lower parts minutely dotted with black.

7. Salmo perisii.

Torgoch.

Torgoch, *Willughby, Hist. Pisc.* p. 196; *Farrington, Philos. Trans.* 1755, p. 210; *Penn. Brit. Zool.* iii. p. 267, or (edit. 1812) iii. p. 407.

Salmo salvelinus, *Donov. Brit. Fish.* pl. 112; *Jenyns, Man.* p. 428.

?Salmo umbla, *Jenyns, Man.* p. 427.

The Charr, *Yarrell, Brit. Fish.* 3rd edit. i. p. 241 (descr. part.) and fig. p. 245.

Salmo cambricus, *Günth. Proc. Zool. Soc.* 1862, p. 49, pl. 6 (not *Donov.*).

Salmo perisii, *Günth. Ann. & Mag. Nat. Hist.* 1865, xv. p. 75.

D. 13 (14). A. 12 (11). P. 12 (13). V. 9. L. lat. 170. Vert. 61. Cæc. pyl. 36.

Body slightly compressed and elongate, its greatest depth being one-fifth or two-ninths of the distance of the snout from the root of the caudal fin; the length of the head is considerably more than one-half of the distance between the snout and the vertical from the origin of the dorsal. Head rather depressed; interorbital space flat, its width being less than twice the diameter of the eye. Males with the lower jaw longest; teeth of moderate strength. Gill-cover overlapping the root of the pectoral. The height of the dorsal fin two-thirds of the length of the head. Length of the pectoral less than that of the head, much more than one-half of the distance between its root and that of the ventral. Sides with numerous red dots; belly red in the mature fish; pectoral, ventral, and anal with white margins.

Lakes of North Wales.

a. Several adult specimens: types of the species. Lake of Llanberris. Presented by T. P. W. Ellis, Esq.

b–d. Adult, mature specimens, 9 inches long. Lake of Llanberris. Presented by T. P. W. Ellis, Esq.; caught in March.

e–f. Immature specimens, 8 inches long, with the belly silvery. Lake of Llanberris. Presented by T. P. W. Ellis, Esq.; caught in March.

g. Six inches long. Lake of Llanberris. Presented by T. P. W. Ellis, Esq.; caught in September.

h. Four and a half inches long. Lake of Llanberris. Presented by T. P. W. Ellis, Esq.; caught in February.

i–k. Adult. From the Haslar Collection.

Description of a Male specimen, 9 inches long.

Body rather compressed and elongate; its greatest depth, which is below the origin of the dorsal fin, is contained five times or four times and one-third in the total length (without caudal). The least depth of the tail is three-fifths or two-thirds of the length of the base of the dorsal fin. The height of the head above the mandibulary joint equals the distance between the posterior margin of the orbit and the end of the operculum. The upper profile of the head is not elevated above the margin of the orbit, and is slightly concave. The diameter of the eye is one-fifth of the length of the head, two-thirds of the extent of the snout, and more than one-half of the width of the interorbital space; the latter is flat, with the median ridge and the lateral series of pores scarcely visible. Snout rather depressed, conical, with the lower jaw slightly curved upwards and overreaching the upper. The *nostrils* are situated midway between eyeball and end of snout; the anterior is round, open, surrounded by a membrane, which posteriorly is developed into a small flap nearly entirely covering the smaller, oblong, posterior nostril. By this character alone the Torgoch may be distinguished from the Charr and Freshwater Herring. The maxillary extends to (or scarcely beyond) the vertical from the posterior margin of the eye, and is armed with 19–21 teeth of moderate size; six or seven teeth in each intermaxillary, seventeen in each mandible; seven teeth on the vomer, forming two sides of a triangle, the point of which is directed backwards; fifteen teeth on each palatine; five pairs on the tongue. The *suboperculum* is produced backwards, covering the triangular portion of the humerus above the root of the pectoral, and being in immediate contact with the latter; the vertical width of the suboperculum is one-half, or rather less than one-half, of that of the operculum. Only three *branchiostegals* are exposed in a lateral view of the fish, the others being situated at the lower side of the head. The lower branch of the outer *branchial arch* is provided with thirteen lanceolate straight gill-rakers; the longest is somewhat less than two lines long in the specimen described.

The origin of the dorsal fin is somewhat nearer to the snout than to the root of the caudal; the length of its base is not much less than its height. The fifth and sixth rays form the rounded top of the fin. The first ray is rudimentary, the second half as long as the third, the

third half as long as the fourth, the fourth simple, five-sixths of the fifth, which is branched, the sixth the longest, the last split to the base. The length of the base of the dorsal is contained once and one-third in its distance from the adipose fin.

The origin of the anal fin is exactly in the middle between the root of the caudal and that of the outer ventral ray; the length of its base is less than that of the dorsal, and not much less than its height. The four anterior rays are enveloped in a common membrane; the fourth and fifth rays form a rounded point; and the lower edge of the fin is slightly emarginate. The first ray is short, the second half as long as the third, the third three-fourths of the fourth, the fourth simple, a little shorter than the fifth, which is the longest and branched; the last split to the base, its length being nearly one-half of that of the fifth.

Caudal fin emarginate, the length of a middle ray being a little more than one-half of that of the outer ones, the length of which is contained six times and a half in the total. Lobes slightly rounded.

The base of the pectoral is overlapped by the gill-cover apparatus. It extends nearly to the vertical from the origin of the dorsal, is considerably shorter than the head, its length equalling three-fourths of the distance between its root and that of the ventral.

The ventral is inserted in the vertical below the eighth to the eleventh dorsal rays, its length being two-thirds of that of the pectoral, or of the distance between the root of its outer ray and the vent.

The scales are very thin and small, deeply imbedded in the skin; one taken from between the dorsal and the lateral line is ovate, two-thirds as high as long. The perforated scales of the lateral line do not correspond to the transverse series. Scales on the back minute.

The back is dark sea-green, which colour becomes lighter on the sides, assuming a yellowish shade and gradually passing into the bright red of the lower parts; sides with numerous reddish orange-coloured dots. Pectoral greenish, passing into reddish posteriorly, the upper margin being white; ventral and anal red, with white anterior margins; dorsal and caudal blackish, with broad lighter margins. Cheeks and suboperculum with numerous black dots.

8. Salmo rutilus.

Ascan. Ic. tab. 32.
Salmo rutilus, *Nilss. Prodr.* p. 10, and *Skand. Faun. Fisk.* p. 430.
—— ascanii, *Cuv. & Val.* xxi. p. 256.

Of this fish scarcely more than the name is known; Nilsson has characterized it thus:—

Yellowish, brownish above, red or orange-coloured below, sides with small light spots. Head small, its length being contained five times and one-third in the total. Snout pointed, with the lower jaw sometimes prominent. Ventrals and anal red, with the anterior margins white.

Lakes of South-western Norway (Hadeland; neighbourhood of the coast in Christiansands stift).

9. Salmo carbonarius.

Kullmund.
Salmo lacustris, *Ascan. Icon.* tab. 33.
—— carbonarius, *Ström, Egers Beskrifv.* p. 122; *Nilss. Skand. Faun. Fisk.* p. 429; *Cuv. & Val.* xxi. p. 254.
—— ventricosus, *Nilss. Prodr.* p. 7.

This fish is but little known; Nilsson characterizes it as follows:—

D. 13. A. 12.

Head and upper parts black; sides greyish, with small rounded white spots. Under parts whitish; fins black; ventrals and anal with the front margin white. Length from 12 to 16 inches.
Lakes of Western Norway.

10. Salmo grayi.

?Salmo alpinus, *Dubourdieu, Hist. of the County of Antrim*, i. p. 119; *Thompson, Ann. & Mag. Nat. Hist.* 1840, vi. p. 448.
Salmo umbla, *Thompson, l. c.* p. 439 (young).
—— grayi, *Günth. Proc. Zool. Soc.* 1862, p. 51, pl. 7, and 1863, p. 12.

D. 13 (14). A. 12. P. 13–14. V. 9. L. lat. 125. Vert. 60. Cæc. pyl. 37.

Body compressed, slightly elevated, its greatest depth being one-fourth of the distance of the snout from the end of the middle caudal rays; the length of the head is scarcely more than one-half of the distance between the snout and the vertical from the origin of the dorsal. Head compressed; interorbital space convex, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; lower jaw very feeble. Teeth very small, four in each intermaxillary, and about sixteen in each maxillary. Length of pectoral equal to, or rather more than, that of the head, terminating at no great distance from the ventral, and extending to, or beyond, the origin of the dorsal. Sides with scattered light-orange-coloured dots; belly uniform silvery whitish, or with a light-reddish shade; fins blackish.
Lough Melvin, Ireland.

a–b. Types of the species. Presented by Dr. A. Günther.
c–g. Adult. Presented by the Earl of Enniskillen.
h–i. Adult. Purchased of Mr. Stevens.

Description of a Male specimen, 11 *inches long.*

Head and body compressed, slightly elevated, its greatest depth, which is below the origin of the dorsal fin, being contained four times in the total length (to the end of the middle caudal rays). The least depth of the tail is considerably less than the length of the base of the dorsal fin. The height of the head above the mandibulary joint is more than the distance between the posterior margin of the orbit and the end of the operculum. The upper profile of the head is elevated above the margin of the orbit, the diameter of which is one-fifth of the length of the head, shorter than the snout, and a

little more than one-half of the width of the interorbital space. The latter is convex, with a prominent ridge along the middle, and with a pair of series of pores. Snout slightly compressed, subconical, with jaws equal anteriorly. The nostrils are situated midway between the end of the snout and the anterior margin of the eyeball; the posterior is the wider and round, the anterior being a very narrow vertical slit; the two are separated by a narrow cutaneous bridge. The *maxillary* extends to the vertical from the posterior margin of the eye, and is armed with sixteen very small *teeth*, the posterior ones being quite rudimentary. All the other teeth small; four in the intermaxillary, twelve in each mandible, two to four on the vomer, fifteen on each palatine, and four pairs on the tongue. The *suboperculum* forms the hindmost part of the gill-cover, and does not cover the exposed portion of the humerus above the root of the pectoral; it is narrow, its vertical width being one-third of that of the operculum. Only the two or three outer *branchiostegals* are exposed in a lateral view of the fish, the others being situated at the lower side of the head. The lower branch of the outer *branchial arch* is provided with nine lanceolate straight gill-rakers; the longest is two lines long in the specimen described.

The origin of the dorsal fin is nearer to the end of the snout than to the root of the caudal; the length of its base is considerably more than that of the last ray, and contained once and two-fifths in that of the fourth ray. The fourth and fifth rays form an acute point, and the upper margin of the fin is nearly straight. The first ray is nearly half as long as the second, the second half as long as the third, the third not much shorter than the fourth; the fourth and fifth are longest, the former simple and the latter branched; the last is split to the base, and nearly half as long as the fifth. The distance of the adipose fin from the dorsal is less than twice the length of the base of the latter.

The origin of the anal fin is in the middle between the root of the caudal and that of the outer ventral ray; the length of its base is less than that of the dorsal, and two-thirds of the length of the fifth ray. The fourth, fifth, and sixth rays are the longest, and form an acute point; the lower margin of the fin is slightly emarginate. The first ray is short, half as long as the second; the second half as long as the third; the third two-thirds as long as the fourth, which is simple; the fifth branched; the last is split to the base, two-fifths as long as the fourth.

Caudal fin forked, one of the middle rays not being quite half as long as the outer ones, the length of which is one-fifth of the total. Lobes pointed.

The base of the pectoral is entirely free, and not overlapped by the gill-cover apparatus. It is as long as, or even longer than, the head, and extends to, or slightly beyond, the vertical from the origin of the dorsal, terminating at a short distance from the ventral.

The ventral is inserted below the ninth, tenth, and eleventh dorsal rays, its length being three-quarters of that of the pectoral; it terminates at no great distance from the vent. In smaller speci-

mens than the one described the two outer rays are somewhat less lengthened.

The scales are very conspicuous, comparatively much larger than in the other British species. Those between the dorsal fin and lateral line are nearly square, with the hind margin rounded. Those of the lateral line are not larger than the others; and their number, therefore, nearly coincides with the number of the transverse series. The scales on the back are the smallest, yet very distinct.

Sides and belly silvery; the scales on the sides of the back have a silvery centre and a blackish margin; the back itself is bluish black; belly with a reddish shade; sides with scattered light-orange-coloured dots; fins blackish; the dorsal lighter superiorly, and with a few light dots at the base; ventral with a narrow whitish margin. Head silvery, black above.

11. Salmo colii.

Günth. Proc. Zool. Soc. 1863, p. 12, pl. 2.

D. 14. A. 12. P. 13. V. 9. L. lat. 160. Vert. 63.
Cæc. pyl. 42.

Body slightly compressed and rather elongate, its greatest depth being contained four times and three-fifths or five times in the distance of the snout from the end of the middle caudal rays. The length of the head is one-half of the distance between the snout and the vertical from the origin of the dorsal fin. Head compressed; interorbital space nearly flat, its width being less than twice the diameter of the eye. Jaws of the male of equal length anteriorly; teeth very small, four to six in each intermaxillary, fourteen to seventeen in each maxillary. Pectoral shorter than the head, terminating at a considerable distance from the origin of the dorsal and of the ventral. Bluish-black above; sides silvery with scattered light-salmon-coloured dots; belly reddish; fins black, the anal and the paired fins with a reddish tinge, the anal and the ventrals with a narrow whitish margin. Pyloric appendages extremely short, the longest being three lines long, the shortest one line.

A small species (7–8 inches long) from Ireland; Loughs Eske, Dan.

a. Several specimens. Lough Eske. Presented by Th. Brooke, Esq. —Types of the species.

b. Female, 6 inches long, with mature ova. Lough Dan. Presented by R. H. Scott, Esq.

Description of a Male and a Female specimens, 7¾ inches long.

Head and body slightly compressed, not elevated, the greatest depth, which is below the origin of the dorsal fin, being contained four times and three-fifths (female) or five times (male) in the total length (to the end of the middle caudal rays). The least depth of the tail is considerably less than the length of the base of the dorsal fin. The height of the head above the mandibulary joint is more than the

distance between the posterior margin of the orbit and the end of the operculum, The top of the profile of the head is scarcely elevated above the margin of the orbit, the diameter of which is one-fifth of the length of the head, somewhat shorter than the snout, and two-thirds of the width of the interorbital space: the latter is but very slightly convex, with a very indistinct ridge along the middle. The nostrils are situated midway between the end of the snout and the orbit. The maxillary extends scarcely to the vertical from the posterior margin of the orbit, and is armed with from thirteen to seventeen very small teeth. All the other teeth are small; four to six in the intermaxillary, fifteen in each mandible, three on the vomer, fifteen on each palatine, and four pairs on the tongue. The subopercular forms the hindmost part of the gill-covers, and does not cover the exposed portion of the humerus above the root of the pectoral; its vertical width is one-half of that of the operculum.

The origin of the dorsal fin is a little nearer to the end of the snout than to the root of the caudal; the length of its base is considerably more than that of the last ray, and contained once and a third in that of the fourth ray; the upper margin of the fin is straight. The first ray is nearly half as long as the second, the second and third half as long as the third and fourth; the fifth, sixth, and seventh are the longest, the former simple, and the two latter branched; the last is split to the base, and half as long as the sixth. The distance of the adipose fin from the dorsal is equal to, or rather less than, twice the length of the base of the latter.

The origin of the anal fin is in the middle between the root of the caudal and that of the outer ventral ray; the length of its base is less than that of the dorsal, and two-thirds of the length of the fifth ray. The fourth, fifth, and sixth rays are the longest, and form an acute point; the lower margin of the fin is slightly emarginate. The fourth ray is simple, the fifth branched; the last is split to the base, half as long as the fourth.

Caudal fin forked, one of the middle rays being two-fifths as long as the outer ones, the length of which is less than one-fifth of the total. Lobes pointed.

The base of the pectoral is entirely free, and not overlapped by the gill-cover apparatus; it is shorter than the head, terminating at a considerable distance from the vertical from the origin of the dorsal; its length is one-half, or not much more than one-half, of the distance between its root and that of the ventral.

The ventral is inserted below the tenth and eleventh dorsal rays, its length being four-fifths of that of the pectoral, and two-thirds of that of the head.

Back bluish black; sides silvery, with scattered light-salmon-coloured dots; belly reddish; fins black, the anal and the paired fins with a reddish tinge, the anal and the ventrals with a narrow whitish margin.

12. Salmo hucho.

Huchen; Rothfisch.
Huch, *Gesner, De Aquat.* p. 1075; *Aldrov.* p. 572; *Willughby*, p. 199, tab. 1. fig. 6.
Salmo no. 6, *Artedi, Genera*, p. 12; and no. 8, *Synon.* p. 25.
Marsil. Danub. Pan.-Mys. iv. taf. 28. f. 1.
Salmo hucho, *L. Syst. Nat.* i. p. 510; *Bl. Fische Deutschl.* iii. p. 152, taf. 100; *Meiding. Pisc. Austr.* tab. 15; *Agassiz, Poiss. d'eau douce*, pls. 12 & 13; *Cuv. & Val.* xxi. p. 226; *Heck. & Kner, Süsswasserf.* p. 277; *Siebold, Süsswasserf.* p. 288.
Hucho germanorum, *m.*

D. 13. A. 12. P. 17. V. 9–10. L. lat. 180. Vert. 68.
Cæc. pyl. ca. 200.

No median series of teeth along the hyoid bone. Head and body elongate, low, the depth of the body being about one-sixth of the total length (without caudal); the length of the head about one-fourth. Head flat above, snout depressed and rather produced. The teeth on the palate are as strong as, or even stronger than, those of the mandible. Præoperculum with the lower limb very distinct. Fins of moderate size; caudal deeply emarginate. Sides silvery, with numerous very small black dots, extending on the head and dorsal fins; old specimens with a reddish hue.

Danube.

a–b, c. Half-grown. Danube.
d. Half-grown: skeleton. From Prof. Agassiz's Collection.

13. Salmo lossos.

Salmo hucho, *Pallas, Zoogr. Rosso-As.* iii. p. 344 (not synon).
Lossos (*Russia*); Streshnewoi Linn (*river Kama*), or Krasnaja ryba.

B. 11. D. 11. A. 10–11. P. 12. V. 9. Cæc. pyl. 24 and more.

Pallas gives the following description:—

Body commonly about two feet long, thick, compressed, convex on either side; back in front of the dorsal fin subangular. Head conical, scarcely compressed, with the snout obtuse; jaws subequal, the lower a little the longer when the mouth is open. Teeth pointed, recurved, distant from each other along the margin of either jaw, those of the lower jaw the longest; similar teeth on each side of the tongue, unequal in number; somewhat smaller ones anteriorly on each side of the palate. Opercles entire, rounded, flexible. Caudal symmetrical, emarginate, with the angles acute. Body with small scales, somewhat silvery, with spots scattered here and there on the scales or their interstices; belly white, without spots. Head with brownish blotches. Total length (of a specimen from the Kama) 2 feet 6 inches; of the head 6 inches 5½ lines; distance from the apex of the snout to the dorsal fin 12 inches 7 lines, to the ventrals 1 foot 8 inches 1 line, to the anal 1 foot 9 inches, to the adipose 1 foot 10 inches 4½ lines, to the caudal 2 feet 3 inches 4 lines; from the snout to the eyes 1 inch 10 lines; length of appendages to the ventral fins 9 lines.

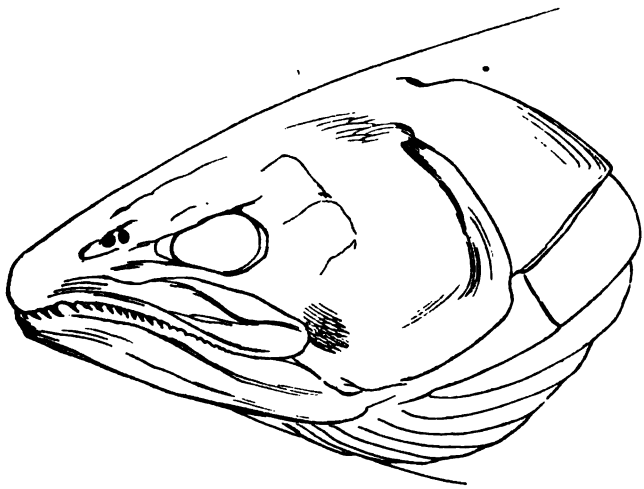
Very frequent in the rivers flowing into the Baltic sea, and a most

delicious fish of the fish-ponds at St. Petersburg, found more rarely in the river Kama, and now also in the Caspian Sea. I have little doubt that this species, which is very seldom taken in the Wolga, enters the Kama by the northern streams flowing into that river, of which several, tributaries of both the Kama and the Kolva, are near to the sources of the streams flowing into the Petschow and the Vitchegda; so that, when the waters are swollen by the snow, the Trout (which usually ascend to the extreme sources of the rivers) would easily be able to cross from one to the other. With reference to the river Muilwa, which flows into the upper Kama, eye-witnesses have assured me that it rises from a marsh which in spring time, being entirely inundated, is changed into a lake, whence a stream flows likewise to the Vitchegda. By these interlacements of the rivers the migratory fish ascending from the ocean have been able to cross into the Kama and there to multiply their species.

II. *Asia.*

14. Salmo fluviatilis.

Salmo taimen, *Pallas, Reise*, ii. App. p. 716; *L., Gm.* p. 1372.
—— fluviatilis, *Pallas, Zoogr. Ross.-As.* iii. p. 359.



B. 11. D. 13. A. 13. L. lat. 187.

Similar in form to *S. fario*; head of moderate size, its length being two-ninths of the total (without caudal). Snout of moderate extent; eye rather small. Maxillary very broad and strong, extending to behind the eye; teeth rather small; vomerine teeth. The lower limb of the præoperculum is oblique and very long. Adipose fin large and thick; caudal emarginate.

We refer only one (No. 85) of the two specimens from Pallas's

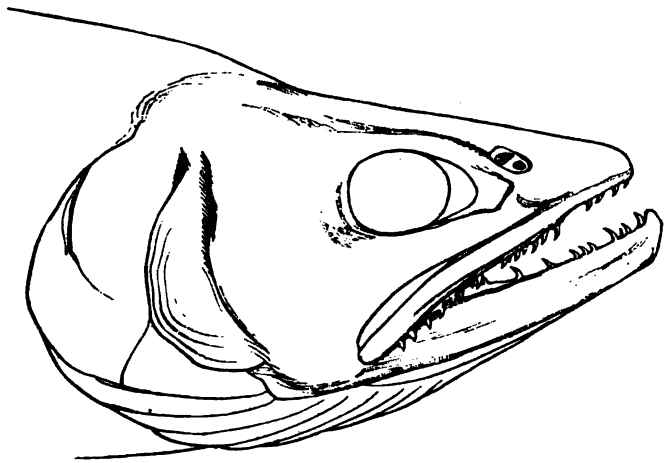
collection, named *S. fluviatilis*, to this species; it is a male, 2 feet long; the other specimen is better referred to *S. coregonoides*. Several characters, as the form of præoperculum, solid bones of the skull, large and thick adipose fin, are found in both fishes; and it is possible that the specimen referred to *S. fluviatilis* may eventually prove to be merely the male of *S. coregonoides*.

Pallas adds the following notes:—

"This fish (which, being a tenant of fresh water, does not appear to be migratory) is taken abundantly in the trans-Ural rivers tributary to the Ob and Irtis, in the rivers flowing to the Jenisey, and in these rivers themselves, as also in the Lena and in the stony rivers collateral with it: in the lower regions of these rivers, towards the sea, it is certainly not observed; indeed even in Lake Baikal it does not occur in great numbers. However, it grows to a remarkable size, and in the Witim and Jenisey, towards Turuchansk, is said to have weighed more than 80 lbs., although its ordinary size may vary between 20 and 40 lbs. It enters also smaller and rapid rivers, as the Liala, Tura, Uba, Tom, and others; but beyond the Lena and its collateral streams, and throughout the Eastern Ocean and in Kamtschatka it is not known. It has appeared of late in the upper river Kama, coming from the alpine streams Jaiwa, Koswa, and others communicating indirectly with the Kama."

15. Salmo erythrinus.

Salmo erythrinus, *Georgi, Reise im Russ. Reich.* p. 186, tab. 1. fig. 1, and *Beschreib. des Russ. Reichs*, iii. p. 1935; *L., Gm.* p. 1368.
—— erythræus, *Pall. Zoogr. Ross.-As.* iii. p. 349.



A Charr from the alpine lake Frelicha, which by a river commu-

nicates with the north-eastern part of Lake Baikal; by Pallas erroneously identified with *S. alpinus*.

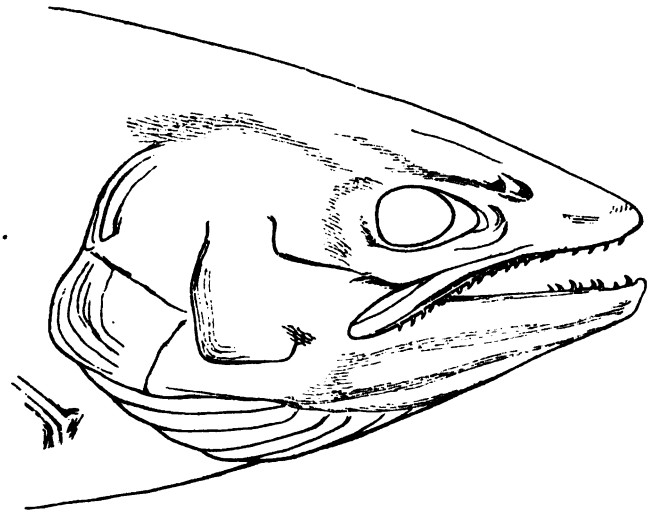
B. 12. D. 14. A. 13. L. lat. 225.

In general form similar to *S. perisii*, the body being rather elongate; head smallish, its length being somewhat less than one-fifth of the length (to the end of the middle caudal rays) in a male specimen 18 inches long. Snout somewhat produced, subconical, much longer than the eye, the diameter of which is one-half of the width of the interorbital space. Maxillary slender and rather feeble, extending a little behind the vertical from the hind margin of the eye. Teeth of moderate strength. Interorbital space flattish. Præoperculum crescent-shaped, without lower limb. Pectoral shorter than one-half of the distance between its root and that of the ventral. Dorsal a little higher than long. Caudal deeply forked. Brown above, red below, red-spotted on the sides; ventral and anal fins red, with white margins.

This species is said to attain to a length of two feet.

The characters given above are taken from a specimen from Pallas's collection in the Berlin Museum; it is the skin of a male fish, 18 inches long, in a tolerably good state of preservation.

16. Salmo callaris.



Salmo callaris, *Pall. Zoogr. Ross.-As.* iii. p. 352; *Cuv. & Val.* xxi. p. 260.

The specimen preserved in the Berlin Museum as one of the types of Pallas's *S. callaris* is a flat skin of a female fish, 18½ inches long,

the palate of which has been cut away. A second specimen (No. 81) is named *S. autumnalis*, but is evidently identical with *S. callaris*; in this I am confirmed by another label attached to the specimen, and of an older date, with the following words in Russian characters:—"From Kamtschatka—Golez—River (name illegible)". The vomer of this specimen is preserved, and bears teeth anteriorly only. The description given by Pallas is very indefinite, yet in the main points it can be applied to these specimens. But if *S. callaris* is a Charr, the entire passage given by Pallas regarding the habits of this fish probably refers to some other distinct Salmonoid. We give first the characters of the specimens mentioned:—

B. 11. D. 14. A. 11. L. lat. 225. (? Vert. 66.)

Body rather low and long, head small, its length being one-fifth of the total length (without caudal fin). Snout of moderate extent, rather pointed, much longer than the eye, which is unusually small. Maxillary very slender and feeble, extending behind the vertical from the hind margin of the eye. Teeth small. Præoperculum with a very distinct lower limb, forming a right angle with the hind limb. Pectoral scarcely shorter than one-half of the distance between its root and the ventral; caudal subtruncated. Lower parts red, sides with numerous small pale-red spots.

Pallas adds the following notes to this fish:—

"These fish enter the rivers from the eastern ocean in great numbers. From the Bay of Okotsk they ascend into the rivers Okota and Kuchtni, the great river (Boloschaia reka) in Kamtschatka and others, even into the rivers of the islands scattered towards the American shores, in order to hybernate, being still without spots. They are said to remain torpid during the winter, in the depths of the rivers, in shoals of thousands, until at the return of spring they seek the sea again, from about the 10th to the 20th of May. They surmount cataracts of whatever height by leaping, and in the same manner escape from nets one fathom deep. They force their way into the Kurile lake near the river Kamtschatka, notwithstanding a very high cataract, and hybernate in it in large numbers. They swim also with great velocity, and, excepting at night, manage to escape the nets. They feed especially on the eggs of various species of Trout, and greatly diminish their numbers. Many remain for a long time in the rivers and lakes; but the greater number return in spring to the sea. When they come up from the sea they are without the red tint and the spots, and shine with a silvery lustre; during the ascent they become gradually spotted with red, while they acquire a more or less red tint beneath the belly and on the fins, according to the comparative rapidity of the river-currents.

"Steller relates in his notes that in the lake above the promontory Kronsk in Kamtschatka, there is taken a variety of *S. callaris* more than 2 feet long, in all points quite similar, but more slender, bigger in the belly, of a livid hue, without silvery lustre, with the belly white, pectoral fins yellowish, ventrals inclining to red, but both pairs with

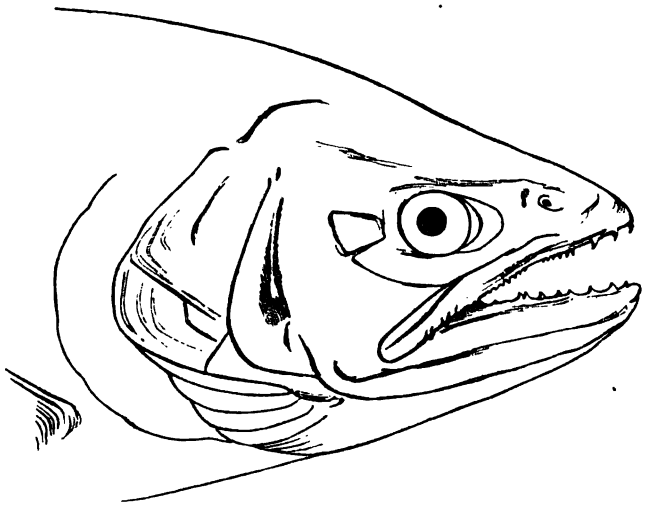
the first ray pure white; anal fin brownish red, with two of the rays white; jaws less curved, branchiostegals fewer by one.

"Steller believes that the migratory fishes do not live beyond the third year; in the lake, however, they attain an age of many more years. He has had young specimens of this variety of one and two years old, 10 to 14 inches in length, the lower fins of which were bright red, the mandible more or less produced. He relates that a variety occurs not only in this lake but also in the lake of the island Caraja, very slender in shape, and almost entirely ferruginous, without spots, very unlike the ordinary variety in appearance. These, he thinks, are hybrids, born in the lake, and the offspring of female *Salmo callaris* and of male *S. sanguinolentus*, of which species many are carried into these lakes, placed at an exceedingly elevated position, by a certain inundation of the sea, together with *S. callaris*, and are both immediately seen to commence propagation and soon afterwards to have their sexes in common, which is not without some semblance of truth."

It is quite evident that the notes given by Pallas above do not refer to a Charr, none of which migrate to the sea, as far as our present experience goes; therefore Pallas appears to have joined the life-history of some fish to specimens of a distinct species. As regards the fish noticed by Steller, no opinion can be offered until the localities mentioned are visited again, and their Salmonoids examined.

17. Salmo leucomænis.

? Salmo kundsha, *Pallas, Reise*, iii. *Append.* p. 706; *Gm. L.* p. 1373.
Salmo leucomænis, *Pallas, Zoogr. Ross.-As.* iii. p. 356; *Cuv. & Val.* xxi. p. 243.



One of the two specimens from Pallas's Collection, named *S. leu-*

comænis, and preserved in the Berlin Museum, is probably the same which is mentioned in the original description. Its total length nearly corresponds with that of which the measurements are given by Pallas, but there are some discrepancies in some of the details. The larger specimen is 33 inches (English) long.

The species is very closely allied to *S. callaris*.

B. 12. D. 13–14. A. 12. L. lat. 200.

Body as in *S. callaris*; head small, its length being one-fifth of the total length (without caudal). Snout of moderate extent, slightly pointed. Eye very small, as in *S. callaris*. Maxillary very slender and feeble, extending behind the vertical from the hind margin of the eye. Teeth small. Præoperculum with a distinct but very short lower limb, the angle being quite rounded. Pectoral considerably shorter than one-half of the distance of its root from the ventral; caudal distinctly emarginate, nearly truncate in old examples. Sides with numerous pale spots, each being about as large as the eye.

There can be no doubt that this fish is a Charr, and therefore it is probable that the following notes added by Pallas refer to a distinct fish:—

"These fish frequent in great numbers the sea-bays and mouths of the rivers both throughout the Arctic Ocean and in the North Pacific, especially *æstri tempore*, not, however, ascending far from the sea. From the bay of Okhotsk to the rivers Kutchni and Okota and in the bay of Kora in the Northern Ocean they make their appearance in the middle of June; and a special fishery of them takes place at some distance from the sea, and lasts throughout the month. In the rivers of Kamtschatka, where they are of the largest size, the species appears as early as about the middle of April, being very uncommon in the river which bears the name of Kamtschatka. It belongs to the marine littoral fish which do not remain long in fresh water, return to the sea in the middle of May, and appear a second time at the end of June. They are also found in the lower part of the river Chatanga."

18. Salmo curilus.

Salmo curilus, *Pall. Zoogr. Ross.-As.* iii. p. 351; *Cuv. & Val.* xxi. p. 244.

A Charr from the rivulets of the Curile Islands.

B. 10. D. 10–11. A. 10. P. 15. V. 10.

In shape slenderer than *S. fario*, with the head and cleft of the mouth shorter. Upper jaw a little shorter, obtuse, with two tubercles above, armed on the margin with sharp, close-set, curved teeth, as is also the margin of the maxillary; the lower jaw with teeth scarcely larger, "sed majores denticuli in arcu palati medio interrupte muricato," and fewer in a double series on the tongue. Opercles of the gills semioval. Caudal somewhat forked, more deeply cleft than in *S. fario*. Body with small scales, blackish above, brownish

olive on the sides, whitish on the belly; a great many spots of a yellow and pallid tint distributed in quincunx form below the lateral line, the pallid spots becoming fewer in number above that line. Length 7 inches 8 lines, of the head 1 inch 7 lines.

A specimen from Pallas's Collection, in the Berlin Museum, marked *S. curilus*?, does certainly not belong to this species, although it is in so bad a state of preservation as to entirely prevent determination.

The notes given by Valenciennes do not add anything to our scanty knowledge of this fish.

19. Salmo lævigatus.

Salmo lævigatus, *Pallas, Zoogr. Ross.-As.* iii. p. 385; *Cuv. & Val.* xxi. p. 245.

The typical specimen is in the Berlin Museum; it is the young of a Charr with very small scales; but in such a bad state of preservation that, without more specimens, the characters of the species cannot be determined. Pallas describes it thus:—

"Hr. Merk furnished me with some fine dried specimens from the rivers of the Kurile Islands. More slender and compressed than *S. fario* or *S. curilus*, with the head short and similar to that of the latter fish, entirely smooth, with very minute punctiform scales, more numerous than I have seen them in any other species of Trout. Head compressed, with the snout very short, obtuse, the jaws being subequal when the mouth is closed, finely toothed as is also the maxillary bone; upper jaw somewhat arched. Arch of the palate concave, without teeth. Gill-covers bent upwards, obtusely rounded, silvery. Gill-membrane with twelve rays. Body silvery, without spots, bluish on the back. Lateral line quite straight along the middle of the side, slightly declining near the head. D. 11. A. 10. P. 13. V. 8. All the fins of the lower parts appear to have been of a brownish colour. Caudal forked, both lobes obtuse, the lower one being very slightly the broader, of an obscure ferruginous tint from the base, becoming brown at the extremity. Total length 6 inches 10 lines, of the head 1 inch 2½ lines."

The following Salmonoids from Kamtschatka were so imperfectly known to Valenciennes from drawings only, that they ought never to have been introduced into the system with specific names:—

Salmo tapdisma, Cuv. & Val. xxi. p. 364.
Salmo arabatsch, Cuv. & Val. xxi. p. 365.
Salmo nummifer, Cuv. & Val. xxi. p. 365.
Salmo melampterus, Cuv. & Val. xxi. p. 366.
Salmo erythrorhynchus, Cuv. & Val. xxi. p. 366; said to be closely allied to, if not identical with, *S. alpinus*.

III. *Western parts of North America.*

We know of two Charr only occurring in the fresh waters of the Pacific side of North America; some of the specimens named by G.

Suckley, may, on reexamination, prove to belong to this group of the genus *Salmo*.

20. Salmo lordii.

D. 11. A. 11. Vert. 63. Cæc. pyl. 26.

Scales minute. Head and body rather compressed; the height of the head equals the length of the head, and is two-ninths of the total (without caudal); the length of the head is one-half of the distance between the snout and the vertical from the origin of the dorsal fin. Snout very obtuse, scarcely longer than the diameter of the eye, which is three-fourths of the width of the interorbital space. The lower jaw is a little shorter than the upper; maxillary of moderate width, scarcely reaching to the vertical from the hind margin of the orbit. Teeth of moderate strength; those along the median line of the hyoid are very small. Præoperculum with a very distinct lower limb. Fins rather small: the length of the pectoral is less than that of the head, without snout, or than one-half of the distance of its root from the ventrals; caudal fin slightly emarginate. Back and sides reddish olive; sides with numerous, round, light-coloured spots. Belly whitish, powdered with reddish olive; paired fins and anal colourless; caudal immaculate. Pyloric appendages very long and wide.

Skaget River, Western slope of the Cascade Mountains.

a–b. Seven inches long. Presented by J. K. Lord, Esq.

This is one of the smallest species of Charr, both our specimens having the abdomen filled with mature ova.

21. Salmo campbelli.

Salmo spectabilis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 218, and *U. S. Pac. R. R. Exped. Fish.* p. 307 (not *Cuv. & Val.*).
—— campbelli, *Suckley, Ann. Lyc. Nat. Hist. New York*, 1861, p. 313, and *Nat. Hist. Wash. Terr.*

These names have been given to a specimen in a bad state of preservation; no distinctive characters are pointed out: the length of the head is two-sevenths of the total (without caudal); maxillary extending to behind the orbit; origin of the dorsal somewhat nearer to the snout than to the root of the caudal. Eye one-fifth of the length to the head. Body with round light spots.

From St. Mary's Mission, on the upper tributaries of the northern branch of the Columbia River.

IV. *Northern and Eastern parts of North America.*

22. Salmo hearnii.

Salmo hearnii, *Richards. Franklin's First Journ.* p. 706, and *Faun. Bor.-Amer.* iii. p. 167.

This Salmonoid is very incompletely known; it was taken in great numbers in the Coppermine River and adjacent sea, and is said to be migratory. It would appear from the description of the teeth that

it is a Charr—"a few teeth on the anterior part of the vomer;" but the author would perhaps have described the teeth of a Salmon in the same words. Scales very small. A. 10. The caudal fin is large, and very entire, being truncated, with a slight rounding of the angles. C. pyl. 30–36, from 1 to 2 inches long.

23. Salmo alipes.

? Salmo stagnalis, *Fabr. Faun. Grœnl.* p. 175.
Salmo alipes, *Richards. Nat. Hist. App. Ross's Voy.* p. lvii, and *Faun. Bor.-Amer.* iii. p. 169, pl. 81, and pl. 86. fig. 1.

B. 11–12. D. 12–13. A. 11. L. lat. 210*.

Body elongate, head of moderate size; snout elongate, pointed, with the lower jaw projecting beyond the upper in adult examples. Teeth small; maxillary elongate, narrow, extending behind the eye. Præoperculum very short in a longitudinal direction, with a very short lower limb. Operculum and suboperculum very conspicuously and densely striated, the striæ radiating from the base of each of the bones. Fins much developed†, the dorsal fin being much higher than long; pectoral very long, its length being more than one-half of the distance between its root and that of the ventral, which, also, is very long. Adipose exceedingly small. Caudal conspicuously emarginate, even in old examples.

Lakes of Boothia Felix and Greenland.

a–b. Stuffed: 32 inches long. Presented by J. Rae, Esq.
c. Stuffed: 18 inches long. Greenland. From Capt. Holböll's Collection.

Salmo stagnalis, Fabr., is, as Richardson already suggested (p. 178), probably identical with *S. alipes*. We possess a stuffed specimen (spec. *c*) which agrees perfectly with the description given by Fabricius, and differs from *S. alipes* in those points only which may be due to age. The bones of the head are remarkably thin, and the caudal is forked, its longest ray being twice as long as a middle ray; dorsal very large, pectoral very long. All three specimens have lost their vomerine teeth.

* This always indicates the number of transverse series of scales above the lateral line.

† Richardson (*l. c.* p. 169) says that, "in the opinion of M. Agassiz, the great length of the fins cannot be regarded as a specific distinction, Trouts inhabiting rapid rocky streams having their fins always much developed." This opinion is not founded on observations in nature. Salmonoids inhabiting such streams are distinguished by *short* fins, the delicate extremities being worn off by the constant activity of those fish, whilst individuals inhabiting still waters show the fins proportionally longer. Hence mature specimens have the fins more rounded and shorter, than sterile ones, on account of their greater activity. This, of course, does not exclude the fact that one species may have longer fins than another, and that the length of the fins may be a good and reliable character.

24. Salmo nitidus.

Salmo nitidus, *Richards. Faun. Bor.-Amer.* iii. p. 171, pl. 82. fig. 1, and pl. 86. fig. 2.

B. 11. D. 13. A. 12. L. lat. 215.

Body somewhat elongate; head of moderate size, its length being one-fifth or rather more than one-fifth of the total (without caudal); snout of moderate extent; maxillary straight, strong, extending in the male behind, and in the female to, the vertical from the hind margin of the orbit. Teeth of moderate size. Teeth not only on the head of the vomer, but also two or three behind it. Præoperculum with the lower limb very distinct. Fins well developed; the length of the pectoral is one-half, or rather less than one-half, of the distance between its root and that of the ventral. Caudal fin conspicuously emarginate, the length of the middle rays being one-half of that of the longest.

These characters are taken from the typical specimen, a male, 21 inches long, from a small lake in the peninsula of Boothia. A second specimen, preserved in the Haslar Collection as *S. hoodii*, proves to be not one of the typical specimens of that species, but is undoubtedly a female of *S. nitidus*; it is also 21 inches long.

25. Salmo hoodii.

Richards. in Ross's Voy. Nat. Hist. App. p. lviii, and *Faun. Bor.-Amer.* iii. pl. 83. fig. 2, and pl. 87. fig. 1 (p. 173, descr. part.).

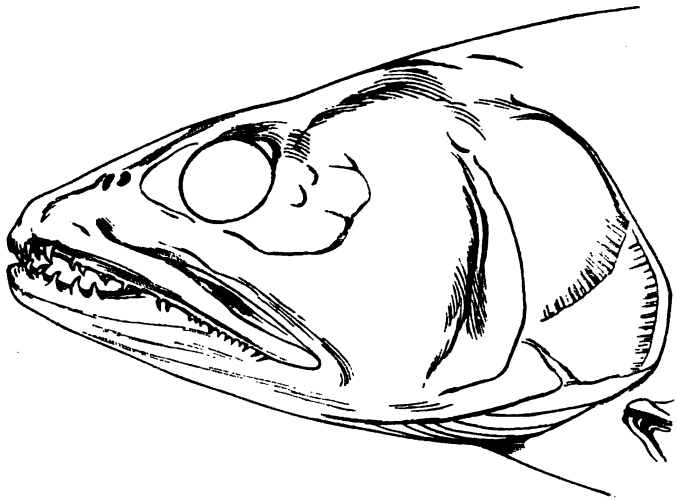
We believe that Richardson has confounded at least two species under this name:—

1. A southern form (Mingan River), with small head and truncate caudal fin, which appears to be identical with *S. fontinalis*; and

2. A species from Boothia Felix, with small head, and with the caudal fin deeply forked.

Only one of the two specimens mentioned by Sir J. Richardson appears to have been preserved: it is in the Haslar Collection, and, although no record of its history has been attached to the specimen, it is evidently the example from Mingan River, described by Richardson, *l. c.* pp. 174–175. There is no sufficient evidence to show that it belongs to a species distinct from *S. fontinalis*, although its truncated caudal fin distinguishes it at once from the *S. hoodii* of Boothia Felix. Also another example, which is clearly nothing but a *S. fontinalis*, was presented by Richardson to the British Museum as *S. hoodii*.

Richardson says that *S. hoodii* is distinguished by a very short head, the length of which is one-sixth of the total length. We do not know whether this is really a specific character, or whether the author had accidentally some small-headed individuals for examination, perhaps females. Therefore we do not think we should be justified in specifically separating two specimens before us which agree with *S. hoodii* of Boothia Felix in all particulars, especially in the deeply forked caudal fin, but have the head considerably larger, viz. one-fifth of the total length.



B. 12. D. 11. A. 10. L. lat. 185*.

Body somewhat elongate. Maxillary rather strong, straight, extending to, or somewhat behind, the vertical from the hind margin of the eye. Præoperculum very short in a longitudinal direction, with

* This always indicates the number of transverse series of scales above the lateral line.

a very short lower limb. The length of the pectoral is less than one-half of the distance of its root from that of the ventral. Adipose fin very small. Caudal deeply forked, the length of its middle rays being one-third of that of the longest. Body and caudal fin covered with round pale spots of moderate size.

Richardson says that this species is common in every river and lake from Canada to the northern extremity of the continent; but we have shown above, that he evidently confounded several species under this name. Our two specimens are probably from Boothia Felix.

a–b. Stuffed: 23 inches long. From the Collection of J. Rae, Esq.
c. ? Young, not in good state. Fort Halkett. Presented by B. R. Ross, Esq.

26. Salmo fontinalis.

Salmo fontinalis, *Mitch. Trans. Lit. & Phil. Soc. New York*, i. p. 435; *Richards. Faun. Bor.-Amer.* iii. p. 176, pl. 83. fig. 1, and pl. 87. fig. 2; *Storer, Report Fish. Massach.* p. 106; *Kirtl. Report Zool. Ohio*, p. 169, and *Bost. Journ. Nat. Hist.* 1843, p. iv. p. 305, pl. 14. fig. 2; *Dekay, Faun. New York, Fish.* p. 235, pl. 38. fig. 120; *Ayres, Bost. Journ. Nat. Hist.* iv. 1843, p. 273; *Cuv. & Val.* xxi. p. 266; *Bingelow, Bost. Journ. Nat. Hist.* vi. 1850, p. 49.
Salmo hoodii, *Richards. Faun. Bor.-Amer.* iii. p. 173, descr. part. (spec. from Mingan River).
Salmo nigrescens, *Rafin. Ichth. Ohiens.* p. 45.
Baione fontinalis, *Dekay, Faun. New York, Fish.* p. 244, pl. 20. fig. 58.
Salmo erythrogaster, *Dekay, Faun. New York, Fish.* p. 236, pl. 39. fig. 126.
Hucho fontinalis, *m.*

B. 12. D. 12. A. 10. L. lat. 200. Cæc. pyl. 34.

No median series of teeth along the hyoid bone.

Form of the body similar to that of *S. umbla*; head of moderate size, with the cleft of the mouth very wide, the maxillary being very long, narrow, straight, extending far behind the eye; it reaches to the vertical from the hind margin of the orbit in specimens 6 inches long. Adult males with the lower jaw prominent. Teeth of moderate size. Præoperculum short in a longitudinal direction, with the lower limb very indistinct. Fins moderately developed: the length of the pectoral is about one-half of the distance of its root from that of the ventral. Dorsal as high as, or higher than, long. Caudal fin in old specimens truncate, in young ones (6 inches long) slightly lunate. Body with numerous pale-red spots; fins generally with a black and orange (or white) marginal band. Dorsal fin with transverse series of brown or black spots.

Rivers and lakes of British North America and of the northern parts of the United States.

a. Stuffed: 22 inches long. From the Collection of the Zoological Society.
b. Stuffed: 19 inches long. Albany River. Presented by Sir J. Richardson as *S. hoodii*.

c. Stuffed: 15 inches. Arctic North America. Presented by J. Ray, Esq.
d. Male, 13 inches long. Sault St. Mary, Lake Superior.
e–i. Skins: 10 inches long. Canada. Presented by Sir A. Smith.
k. Many skins: from 5 to 11 inches long. Rivers running into Lake Cayuga. From Mr. Parnell's Collection.

27. Salmo hudsonicus.

Salmo hudsonicus, *Suckley, Ann. Lyc. Nat. Hist. N. York*, 1861, vii. p. 310.

Head small and conical. Mouth quite small. Teeth small; a few on the head of the vomer; none on its shaft. Tail broad, and usually barred. In some specimens the bars appear to have faded out. Upper parts dark (bluish?); sides brighter; belly white. The whole fish quite silvery. Scales small, but larger than in *S. fontinalis*; they are firmly adherent, and quite conspicuous. Flanks of adults above and below the median line covered with light spots about the size of small peas. Integument over first ray of pectorals of a light orange or reddish colour; that over the next ray dark. Female nearly similar. Would not be easily confounded with any Atlantic species except *S. fontinalis*, but has smaller head, larger spots, and larger, more adherent, and thicker scales. (*Suckley.*)

Hudson's Bay and vicinity, Labrador, Newfoundland.

28. Salmo sebago.

Salmo sebago, *Girard, Proc. Ac. Nat. Sc. Philad.* 1853, p. 380.

Some Salmonoid from the southern part of the state of Maine, with 115 scales in the lateral line. No mention is made of the vomerine teeth, or whether the fish is migratory or not. The posterior half of the maxillary is described as regularly and most decidedly curved downwards, but it is not said whether this is the case in both sexes, or in one sex only. Body, dorsal and caudal fins with subquadrangular or subcircular black spots. Caudal fin regularly crescent-shaped.

29. Salmo gloverii.

Salmo gloverii, *Girard, Proc. Ac. Nat. Sc. Philad.* 1854, p. 85; *Harris, ibid.* 1858, p. 135.

D. 14. A. 10. V. 10.

Some Salmonoid from the upper affluent of the Union River, in the State of Maine, insufficiently described, the dentition of which is unknown. The maxillaries extend backwards to about the posterior margin of the orbit. Caudal fin deeply emarginate. [The adipose fin, in the male, is situated opposite the anterior margin of the anal, whilst in the female it corresponds to the posterior margin of the same fin.]* The scales are somewhat smaller than in *S. sebago*, but larger than in *S. oquassa* or *S. erythrogaster*; opercles and back densely covered with black irregular spots.

* We doubt very much the correctness of this observation.

For some additional remarks on specimens believed to be of the same species, see *Harris, l. c.*

30. Salmo oquassa.

The Charr of Moosemegantic Lake.
Salmo oquassa, *Girard, Proc. Bost. Soc. Nat. Hist.* iv. 1854, p. 262.

It is from 8 to 10 inches in total length. The body is subfusiform, slender, and the most graceful in the Trout family. The head is proportionally small, conical, coregonoid in shape. The mouth is smaller than in *S. fontinalis*. Differences are likewise observed in the structure of the opercular apparatus. The fins have the same relative position as in the Brook-Trout, but are proportionally more developed, with the exception of the adipose, which is considerably smaller; their shape is alike, except that of the caudal, the crescentic margin of which is undulated instead of being rectilinear. The scales are somewhat larger, although they present the same general appearance as those of the Brook-Trout. The lateral line is similar in both of these species. A bluish tint extends all along the back from the head to the tail; so that when seen from above, the fish appears entirely blue; hence the name of Blueback, given to it by the settlers of the neighbourhood. The sides and abdomen are silvery white in the female, and of a deep reddish orange in the male, and the sides are spotted in both sexes with orange of the same hue as the abdomen. The dorsal and caudal fins are brownish blue, bordered with pale orange in the male; the pectorals, ventrals, and anal of a fiery orange, blackish blue at their base, with their margin of the purest white.

The abode of the 'Blueback' is, as stated above, the Moosemegantic Lake, in which it is concealed during the greater part of the year; but about the 10th of October it comes near shore and ascends in shoals the Kenebago for the purpose of spawning. Half a mile above its mouth the Kenebago receives the outlet of Lake Oquassa; the Trout there leaves the Kenebago to the left and runs towards Oquassa Lake, where its voyage comes to a close. After the middle of November it goes back into Moosemegantic Lake and is seen no more until October of the next year. (*Gir.*)

An apparently very extraordinary Salmonoid is described by Valenciennes, which, if the characters given prove to be correct, will be the type of a distinct genus. The specimens are said to come from the River de la Mana in Guiana; however, it is well known that Valenciennes is very inaccurate in his statements as regards the localities whence he obtained his specimens of Salmonoids. We cannot believe that a Salmonoid occurs in Guiana, and may mention that there is a river of the same name in Greece.

31. Salmo gracilis.

Cuv. & Val. xxi. p. 265.

B. 10. D. 12. A. 12. P. 12. V. 10.

Body elongate and rounded, its depth being one-eighth or one-

ninth of the total length. Jaws of equal length, armed with small teeth. Tongue with ten or twelve teeth on each side; also the end of the hyoid bone is armed with small teeth. Body with ten or twelve cross bands, without other markings.

Eight and a half inches long. River de la Mana.

2. ONCORHYNCHUS.

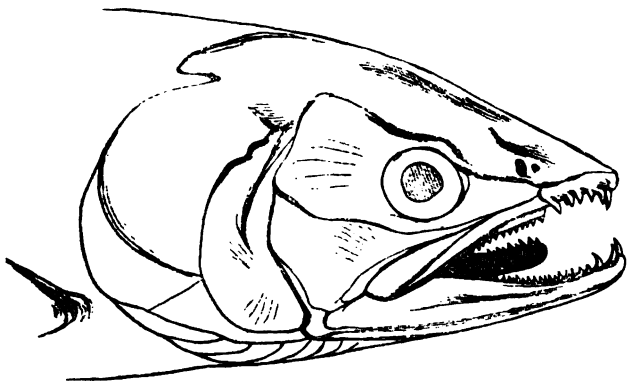
Oncorhynchus, *Suckley, Ann. Lyc. Nat. Hist.* 1861, p. 312.

Body covered with small scales. Cleft of the mouth wide, the maxillary being long, lanceolate, extending behind the orbit in the adult fish; adult males with both jaws hooked and armed with very large teeth. Teeth on the shaft of the vomer, but generally lost with age; teeth on the tongue present; none on the hyoid bone. Dorsal fin short; anal fin rather long, with more than fourteen rays. Pyloric appendages in great number. Ova large.

Migratory fish, ascending the American and Asiatic rivers flowing into the Pacific.

Although we adopt the genus proposed by Dr. G. Suckley, we found it upon a character entirely neglected by that author, namely the elongate anal fin, caused by an increased number of the rays, which is of greater importance than the hook-like production of the upper and lower jaws in the males.

1. Oncorhynchus lycaodon.



Specimen *a*; two-thirds the natural size

Salmo lycaodon, *Pall. Zoogr. Ross.-As.* iii. p. 370.
—— japonensis, *Pall. l. c.* p. 382 (female).
—— dermatinus, *Richards. Voy. Herald, Zool.* p. 168, pl. 33. figs. 3–5 (old male, after spawning; the præoperculum, which is shrunk in the typical specimen, is represented too narrow).
—— consuetus, *Richards. l. c.* p. 167, pl. 33. figs. 1, 2 (male, not full-grown).

Fario argyreus, *Girard, Proc. Acad. Nat. Sc. Philad.* 1856, p. 218; and *U. S. Pac. R. R. Exp. Fish.* pl. 70, p. 312.

B. 14. D. 13. A. 15–17. L. lat. 125–130. L. transv. $\frac{20-23}{25}$. Cæc. pyl. 73. Vert. 64.

In habit similar to *Salmo salar*. Præoperculum irregularly crescent-shaped, with the margins rounded, and with the angle very obtuse; *it is very broad*, as broad as, or broader than, the orbit. Vomerine teeth rather feeble, in a single series, a part of them being lost with age. Teeth on the tongue present*. The scale-like appendage in the axil of the ventral long, half as long, or more than half as long, as the fin. Caudal fin forked. There are twelve scales in a series obliquely descending forwards from the axil of the adipose fin to the lateral line.

A male, 32·4 *inches long, from the Yukon River*.—Snout very much produced, both jaws forming a hook, the upper being bent downwards, the lower upwards. The intermaxillary teeth and the anterior ones of the lower jaw are exceedingly strong, especially the pair nearest to the symphysis, and hook-like. The maxillary is feeble, extending far beyond the orbit. Skin thickened, especially on the back. Caudal fin with the outer rays more than twice as long as the inner ones. Belly dark brown.

A male, 23 *inches long, from Vancouver Island* differs from the former only in having the jaws less curved into a hook. The teeth on the tongue form two series, and are rather strong and closely set.

A male, 20 *inches long, evidently taken before spawning*, has the snout pointed, but none of the jaws are bent; the maxillary is rather feeble, extending backwards to below the hind margin of the orbit.

A female, 22 *inches long* (skin from Pallas's Collection), has the snout much shorter, and a feeble maxillary which just reaches to below the hind margin of the orbit. The skin is scarcely thickened, the scales on the back being very small.

Females, 12 *inches long, from Vancouver Island*, do not differ from older ones, except in having the caudal fin more deeply excised, the length of the middle rays being two-fifths of that of the outer ones. These specimens are silvery, immaculate, with the exception of a few spots on the head. Dorsal and caudal fins blackish.

a. Male, 23 inches long: stuffed. Vancouver Island. Collected by Mr. J. K. Lord.

b. Female, 12 inches long. Esquimalt Harbour. Collected by Mr. J. K. Lord; presented by Earl Russell.

c. Female, 13 inches long. Esquimalt Harbour. Collected by Mr. J. K. Lord; presented by Earl Russell.

d–e. Young. Bay of San Francisco. Purchased of Mr. Gruber.

Besides the specimens mentioned, I have had for comparison the types of *S. dermatinus* (Richards.), *S. consuetus* (Richards.), and two flat skins from Pallas's Collection, about which a few words must be added. They are marked "91. *Salmo leucichthys*" and "76. *Sal-*

* They are lost in the typical specimen of *S. dermatinus*, which is probably accidental.

mo japonensis;" but on comparing the former with Pallas's description of *Salmo leucichthys*, it is quite evident that this cannot be the fish so named by Pallas, and that some confusion of the labels has taken place. As regards the second specimen, we find in the same collection another fish (no. 75) named *S. japonensis*, which is the *Salmo scouleri* of Richardson. We cannot think that Pallas entertained for one moment the idea of an identity of the specimens 75 and 76, and we suppose that 76 only can be considered a typical specimen of *S. japonensis*. Probably one or both of the specimens marked 91 and 76 belong to the species named *S. lycaodon* by Pallas; yet it is not impossible that he referred one to *S. proteus*, a species very closely allied to *S. lycaodon*.

Pallas and Richardson agree that this is a migratory species, which, according to the former, ascends the rivers entering the Sea of Okhotsk in the month of May; it is equally abundant on the American side of Behring's Sea, and known to the fur-hunters on the Yukon River by the name of "Redfish."

2. Oncorhynchus proteus.

Salmo proteus, *Pall. Zoogr. Ross.-As.* iii. p. 376.

In the Collection of Pallas's specimens in the Berlin Museum there is the flat skin of a male Salmonoid, 15 inches long, marked "no. 89. *Salmo trutta*," which probably was one of the specimens which served Pallas for the description of his *Salmo proteus*. The label was evidently misplaced, as there cannot be the slightest doubt that Pallas never would have determined a Salmonoid with seventeen anal rays as *Salmo trutta*.

If we are correct in referring this specimen to *Salmo proteus*, being induced to do so by the statement of Pallas that it has small scales, "*corpus microlepidotum*" (which character cannot be assigned to *S. lycaodon*), *S. proteus* would be nearly allied to *S. lycaodon*, differing from it in the much narrower præoperculum, smaller scales, and less deeply emarginate caudal fin.

It would appear that Steller's remarks, quoted by Pallas for this species, are better referred to *S. lycaodon*; there is, at present, no evidence of this species occurring on the American continent.

The species may be characterized from the specimen mentioned as follows:—

B. 15. D. 12. A. 16.

In habit similar to *S. salar*. Præoperculum with the margins somewhat rounded and with the angle rather obtuse; it is not broad, but much narrower than the orbit. Vomerine teeth in a single series, rather feeble, distant from one another; jaws slightly curved, with teeth of moderate size [in older individuals probably similar to those of *S. lycaodon*]; maxillary narrow, feeble, extending to below the hind margin of the orbit. The appendages in the axil of the ventral more than half as long as the fin. Caudal fin slightly emarginate, the middle rays more than half as long as the outer ones.

Scales small, especially those on the back (owing to the bad state of the specimen the scales cannot be counted).

Pallas says that this species ascends in great numbers the rivers of Kamtschatka and Siberia in the middle of July. Before and during the spawning-time a hump is developed on its nape, and both jaws are much bent. After spawning, in the month of August, all the individuals perish.

3. Oncorhynchus paucidens.

Salmo paucidens, *Richards. Faun. Bor.-Amer.* iii. p. 222.

B. 13. D. 12. A. 17. Vert. 66?

Back of head and body bluish grey; sides ashy grey, with a reddish tinge; belly white. No trace of spots on the body or fins. Commissure of the mouth very oblique, approaching to vertical, dorsal profile quite straight; tail forked. Teeth sparingly scattered and feeble on the jaws, only a few short weak ones on the anterior extremity of the vomer and on the palate-bones. (*Richardson.*)

This Salmon ascends the Columbia, and has an average weight of three or four pounds.

4. Oncorhynchus quinnat.

Salmo quinnat, *Richards. Faun. Bor.-Amer.* iii. p. 219. [? *Girard in Proc. Acad. Nat. Sc. Philad.* 1856, viii. p. 217; and in *Pac. R. R. Exp. Fish.* p. 306, pl. 67; ? *Suckley, Nat. Hist. Wash. Terr.* p. 321.]

A migratory Trout from the Columbia River.

This species is scarcely known; it appears to be closely allied to *S. lycaodon*, differing, perhaps, in having 66 vertebræ, 155 pyloric appendages, and 17 branchiostegals. D. 14. A. 16. Dr. Gairdner wrote in the description addressed to Richardson, that the fish has "*large scales*" (a statement copied in the compiled notes of Suckley); but we do not know what-sized scales were designated "large" by Dr. Gairdner. The scales of the fish figured by Girard, and adopted for Suckley's account, are decidedly *very small*. According to Richardson, the vomerine teeth would be small, and disposed in a single series.

Quinnat is the name given to this and, probably, to other Salmonoids by the Indians, and signifies "glittering," as Mr. Lord informs me. It is very singular that the Welsh use the same word, Gwyniad, for Salmonoids of a particularly silvery appearance. The meaning of the Welsh word is the same.

5. Oncorhynchus scouleri.

Salmo scouleri, *Richards. Faun. Bor.-Amer.* iii. p. 158, pl. 93, & p. 223.
Salar scouleri, *Cuv. & Val.* xxi. p. 345.

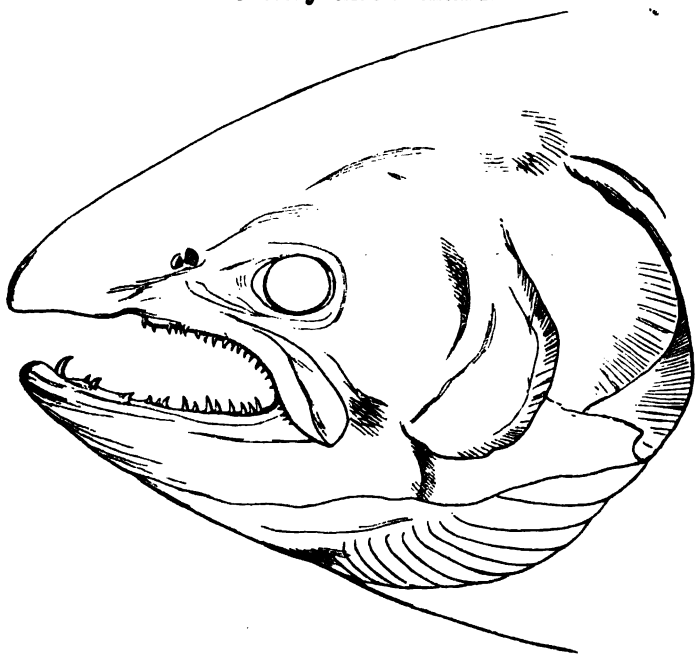
B. 13. D. 14–15. A. 17. V. 11. L. lat. 170. L. transv. 33/44.

Form of the body rather slender [males with a hump of fat on the back during the spawning-season]. Præoperculum very short in the longitudinal axis of the body, without lower limb; it is as broad as, or even broader than, the orbit. Maxillary feeble, straight, extend-

ing far beyond the orbit in old males. [Males during the spawning-time have the intermaxillary much produced, strongly bent downwards beyond the mandible, and armed with strong teeth. The mandible is extremely long, terminating in a knob which bears a cluster of very strong teeth on each side. The snout of these males is so long that the eye occupies the middle of the length of the head.] Vomerine teeth persistent, forming a series which is double, at least anteriorly. The appendage in the axil of the ventral fin is more than half as long as the fin. Caudal fin emarginate, the length of the middle rays being contained once and three-fourths in that of the outer ones. There are about eighteen scales in a series obliquely descending forwards from the axil of the adipose fin to the lateral line. Caudal fin with small brown spots.

These characters are taken from the typical specimen, the skin of a male fish from Observatory Inlet: a second specimen, marked "75. *Salmo japonensis*," is in Pallas's Collection; but it is evident that this cannot be the type of *S. japonensis*, Pall., which is described as having *squamæ mediocres*, whilst *S. scouleri* is distinguished by its very small scales.

6. Oncorhynchus orientalis.



Salmo orientalis, *Pallas, Zoogr. Ross.-As.* iii. p. 367; *Cuv. & Val.* xxi. p. 356.

B. 15. D. 14. A. 19. L. lat. 145. L. transv. 33/43.

Form of the body as in *Salmo trutta*. Præoperculum perfectly

crescent-shaped, without angle, but with a rounded lower limb which is not much shorter than the hind limb; posterior margin of the operculum and præoperculum very obtusely rounded. Maxillary rather feeble and narrow [bent, not much extending beyond the eye in a male specimen 3½ feet long. Lower jaw bent upwards, with some strong teeth at the symphysis]. Vomerine teeth ? The scale-like appendage in the axil of the ventral very long, three-fourths as long as the fin, with the upper and lower edges dilated (*carinato-bilamellata*, Pallas, as it appears in a dried state). Caudal fin emarginate, the middle rays being half as long as the outer ones; there are fourteen scales in a series obliquely descending forwards from the axil of the adipose fin to the lateral line.

This fish may be easily recognized by the large number of anal rays. The characters are taken from one of Pallas's typical specimens, preserved in the Berlin Museum. It is evidently a male; the specimen is a perfectly flat skin, 3 feet 7 inches long; head 8 inches, pectoral fin 4¾ inches; middle caudal rays 2½ inches, outer caudal rays 5 inches.

Pallas gives the following account of the habits of this fish, from the notes made by Steller:—

They ascend only the larger rivers, and are not taken anywhere beyond the fifty-sixth degree of latitude, around the shores of Kamtschatka. They approach the river Kamtschatka as early as about the 20th of April, the river Bolschaya towards the 10th of May; lastly, Port St. Peter and St. Paul, and the Bay of Avatscha in June. They are held in the greatest estimation, and are preferred to all the other migratory fish, not only on account of their size, in which they often attain forty or even sixty pounds, but also on account of their flavour. As soon as these fishes ascend the rivers, they cease to take any food to the time of their death, which is caused by exertion and inanition* after they have shed their spawn and milt, as *S. lycaodon*, &c.

7. Oncorhynchus sanguinolentus.

Salmo sanguinolentus, *Pall. Zoogr. Ross.-As.* iii. p. 379.

B. 14. D. 11. A. 14 (17?). P. 14. V. 10.

Pallas gives the following description from Steller's notes:—

The largest measure three feet, being ten to twelve pounds in weight; greatest breadth 7½ inches. Head oblong, compressed, with the snout obtusely conical, the upper jaw much the longer, hooked, whence the oral aperture gapes even when the jaws are closed. Both jaws, as also the maxillaries, armed with curved teeth; larger ones in the lower jaw, gradually smaller towards the angle of the mouth. Tongue with six teeth, disposed in two series. Irides dirty yellow. Body with rather large scales, adhering firmly to the skin. Colour, in a specimen from the sea, brown, with a green tinge on the back, with scattered black dots; silvery on the sides, glittering; white on the belly. In specimens taken in the river about the beginning of October, back tinged with dirty blackish brown; sides suffused with a blood-hue; belly white, not glittering. Anal fin with fourteen rays;

* *media*, evidently a misprint for *inedia*.

first ray composed of four, which are closely attached. Caudal bluish, crescent-shaped, stout, with the lobes pointed. Dorsal fin, adipose, and upper lobe of the caudal variegated with dots.

I offer this fish, of which I have obtained an imperfect specimen, on the authority and from the description of Steller; and, according to him, it is the species of Salmon which latest ascends the rivers of Kamtschatka gregariously; it rarely arrives before the middle of August. On quitting the sea it is entirely white, and shines like the most polished silver. Then also the snout is as yet straight, not produced, becoming towards October elongated and turned upwards. It prefers especially the rivers which issue from lakes; hence they just enter the river Bolschaya, but immediately turn into the river Oschernaya, or steer quickly towards the lake whence the river Bolschaya issues; so that in the river itself they are hardly seen longer than a week, whereas in the lakes they are found up to January, only being then in a very lean condition. The sides, which are blood-red in October, are then of a brick-red tint, the back greyish brown, the belly white.

8. Oncorhynchus lagocephalus.

Salmo lagocephalus, *Pall. Zoogr. Ross.-As.* iii. p. 372.

B. 13–15. D. 14. A. 18. P. 14. V. 10. Cæc. pyl. 180.

Pallas gives the following description:—

Size generally 2 feet and some inches. Head thick, convex above, with the snout shorter and more obtuse than in any other salmon, gibbous towards the front. Jaws somewhat more pointed in the males, with stout, unequal, curved teeth; the lower a little the longer, with the apex pointed and a little recurved, the teeth being inclined inwards. In fish which have wandered for a longer time in the rivers, the upper and lower jaws are curved inwards, so that they are unable to close the mouth; lower jaw with ten points on each side, as though punctured with a needle. Eyes rather large. Body oblong, plump, slightly compressed, covered with scales of moderate size; lateral line broad. Appendages of the ventral fins awl-shaped, equal to half the fin. Caudal forked, robust. Length from tip of mandible to end of caudal fin 2 feet 3 inches 2 lines, length of head 5 inches 4 lines, length to the dorsal fin 1 inch 9 lines, breadth of the latter 2 inches 3 lines, thence to the adipose 5 inches 8 lines, from this to the caudal 2 inches 8 lines; distance to ventral fin 1 foot 3 lines, thence to the anal 4 inches 9 lines, breadth of the latter 2 inches 3 lines, thence to the caudal 2 inches 6 lines, length of caudal 4 inches 2 lines, greatest height of body 4 inches 9 lines, thickness 2 inches 8 lines. According to the observations of Steller, there are as many as 180 appendages in this species, not only round the pylorus but as far as the curvature of the stomach.

Both from the Northern Pacific and the Bay of Okhotsk this species does not generally ascend the rivers before the middle of July or the month of August, with the single exception of the river Itscha, where both sexes make their appearance as early as May, being only of

smaller size and with the ovaries as yet imperfectly developed. In the rivers of Kamtschatka they do not arrive till after *Salmo lycaodon* and *orientalis*; and then more perfect specimens of *S. lagocephalus* are observed in great numbers again ascending the river Itscha. However, it is said that all, after the deposition of their eggs and milt, gradually perish in the rivers and do not return to the sea.

Subatka, a migratory Trout from the Amur.

Pall. Zoogr. Ross.-As. iii. p. 382.

"In the rivers near the Amur sending their waters into the North Pacific Ocean, there is found a fish called by the Russians in those parts *Subatka* (i. e. Dentex), which is as yet very little known, as it is seldom caught; and a fresh specimen has never yet been brought to me. From the accounts I have received of it from others, and from a dried head which was brought to me, it seems to be a species of migratory Salmon-Trout. Snout long, pointed, curved; jaws toothed, with the two anterior teeth on each side larger than the others, curved, nearly one inch long. It is asserted to be one ell in length, somewhat compressed, broad, 1½ span in breadth, with the back towards the head gibbous, towards the tail attenuated; with small scales, the colour being obscurely bluish; the same on the fins; caudal fin broad, compressed beneath. The ovary in this specimen was filled with large ova, of a very agreeable flavour; and the flesh is also pleasant to the taste. It appears in autumn in the river (which is then already becoming frozen), and is taken more rarely at the mouths of the rivers Derbul and Chaul in Argunum. However, it is said to be more plentiful at the mouth of the river Uro." (*Pallas*).

Suckley, Ann. Lyc. Nat. Hist. 1851, has named several examples in a bad state of preservation from North-western America; but the characters assigned to his species are so vague that it is sufficient to enumerate the names:—

1. *Salmo canis*, l. c. 1858, p. 9, & 1861, p. 312; Nat. Hist. Wash. Terr. Zool. p. 341.—Puget Sound.
2. *Salmo gibber*, l. c. 1858, p. 6.—Puget Sound; Vancouver's Island*.
3. *Salmo confluentus*, l. c. 1858, p. 8; Nat. Hist. Wash. Terr. Zool. p. 334.—Fort Steilacoom.
4. *Salmo cooperi*, l. c. 1861, p. 311.—Columbia River.

3. BRACHYMYSTAX.

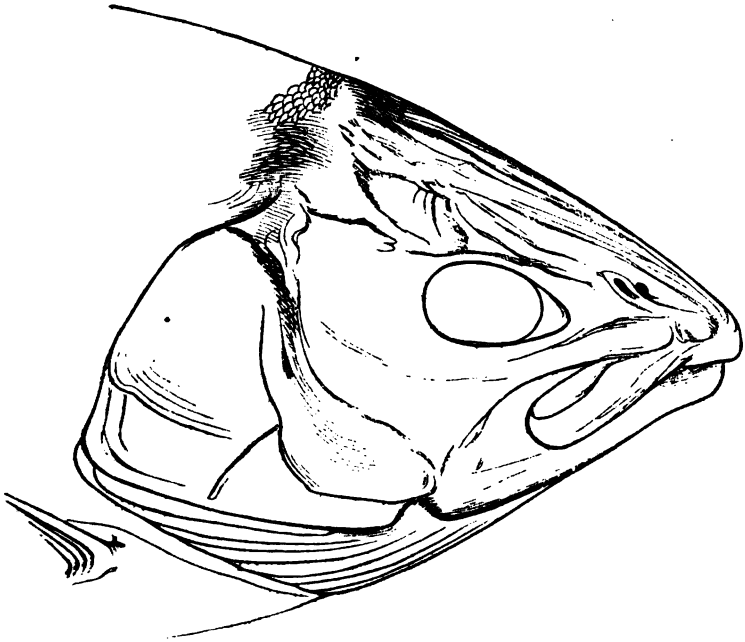
Body covered with very small scales. Cleft of the mouth of moderate width; maxillary broad, rather short, extending to below the anterior part of the eye in the adult fish; upper jaw rather longer than the lower. Teeth rather feeble; vomer with teeth anteriorly only. Dorsal and anal short. Pyloric appendages ? Ova small.

Siberian rivers.

* Identified with *S. proteus* (Pall.) in Nat. Hist. Wash. Terr. Zool. p. 339.

This genus is intermediate between *Salmo* and *Coregonus*. Even if *Salmo fluviatilis* (p. 141) should prove to be the male of *Salmo coregonoides*, still the small size of the ova would be a character of sufficient importance to separate these fishes generically from *Salmo*.

1. Brachymystax coregonoides.



Salmo lenok, *Pallas, Reise*, ii. *Append.* p. 716; *L. Gm.* iii. p. 1373.
—— coregonoides, *Pallas, Zoogr. Ross.-As.* iii. p. 362; *Cuv. & Val.* xxi. p. 272.

B. 11–12. D. 14. A. 12–13. L. lat. 144–164.

Habit stout; head of moderate size, its length being two-ninths of the total (without caudal); bones of the head very solid. Snout of moderate extent, broad, obtuse; teeth small; vomer with teeth anteriorly only. Maxillary similar to that of a *Coregonus*, short and broad, not extending to below the middle of the eye. Præoperculum with a long lower limb. Adipose fin large and thick; caudal deeply emarginate. Body with numerous brown spots.

We refer two specimens from Pallas's Collection to this species: one (no. 86) is 18 inches long, and evidently the typical specimen; the other (no. 84) is 21 inches long, and, although named "*G. fluviatilis* var. *taimen*," is most certainly another individual of the same species.

"It abounds in rivers and the strong mountain-torrents of the Altai, which are tributaries of the Ob and Irtis, as also in the col-

lateral streams of the Jenisey, and in these rivers themselves, also in Lake Baikal and the rivers Angara and Selenga communicating with it, which it ascends at the end of March, before the ice is broken up; but it is replaced by *S. fluviatilis* towards the autumn. Found also in the Lena and the Witim and in the Kovyma; in the Witim they are said to grow to the weight of 80 lbs.; in other rivers the largest scarcely attain to 60 lbs. Many remain in the rivers, which they ascend in early spring to deposit their spawn, and the younger ones especially remain some time, whence they fall into the nets in all seasons, and, with *S. fluviatilis*, *Thymallus*, and *Cyprinus tschebak*, *Gobius*, and *Cobitis*, are almost the sole inhabitants of these rivers. About cataracts and wherever the water is much agitated they are taken with hooks in all seasons. Flesh white, inclining to red, of excellent flavour. Ova small, yellow, like those of the Sturgeon. It is not found in the waters of Kamtschatka, nor in the North Pacific. However, it is said to be found in Japan."

4. LUCIOTRUTTA.

Body covered with scales of moderate size. Cleft of the mouth wide; maxillary long, broad, lanceolate, extending far backwards. Lower jaw much projecting beyond the upper. Dentition very feeble, the teeth being extremely small; maxillary toothless; vomer, palatine bones, and tongue with narrow bands of minute, villiform teeth. Pyloric appendages in great number. Gill-rakers rigid, awl-shaped, and rough interiorly.

Migratory Trout from Arctic North America; (? Siberia and Russia).

1. Luciotrutta mackenzii.

Inconnu, *Mackenzie, Voy. in N. Amer.* p. 9, and elsewhere.
Salmo mackenzii, *Richards. Frankl. Journ.* p. 707, pl. 25. f. 1; and *Faun. Bor.-Amer. Pisc.* p. 180, pl. 84.

B. 10. D. 15. A. 18. V. 12.

Body rounded, rather elongate; head long and compressed, with flattened vertex; eye not very large; præoperculum much curved. Dorsal fin nearer to the caudal than to the snout; caudal forked. Coloration uniform. (*Rich.*)

River Mackenzie and its tributaries. Attains to a weight of 15 pounds and more.

2. Luciotrutta (?) leucichthys.

I suppose that *S. leucichthys* of Güldenstädt also belongs to this genus. The distensible mouth, projecting lower jaw, truncated upper jaw, small teeth on the palate, smallish eyes, ten branchiostegals, &c. are characters which the Asiatic fish has in common with the Inconnu of the Mackenzie. Güldenstädt and Pallas describe the jaws as toothless, whilst Lepechin expressly mentions these teeth; perhaps they are deciduous. The *figure* given by Lepechin is very dissimilar to that of the Inconnu, but these fishes

may prove to be more closely allied on comparison of actual specimens. The following notes are an abstract of Güldenstädt's description:—

Salmo leucichthys, *Güldenst. Nov. Comm. Petrop.* xvi. p. 533; *Pall. Zoogr. Ross.-As.* iii. p. 392.

—— nelma, *Pall. It.* ii. p. 716; *Lepechin, Reise*, ii. p. 192, taf. 9. figs. 1–3.

B. 10. D. 15. A. 14. V. 11. [Vert. 65, *Lepechin*].

Statura et magnitudo *S. salaris*. Rostrum obtusissimum: mandibula superior latissima, integra, recta; inferior adscendens, subconica, apice tuberculoso, ante superiorem prominens; utraque edentula; rictus terminalis amplissimus, quadratus; lingua triangularis, soluta, subaspera; oris cavitas alba, immaculata; palatum latum, planum, antrorsum utrinque subasperum denticulis minimis, tactu, non visu, percipiendis; nares medium inter rostrum et oculum occupantes, apertura utrinque gemina, angusta; oculi laterales, liberi, ampli. Squamæ pro mole piscis haud adeo magnæ. Anus caudæ multo propior, quam capiti, proxime ante pinnam ani, apertura duplici.

Magnitudo tripedalis vulgo, non raro ultra.

Caspian Sea; periodically ascending the Wolga and other rivers of Russia. According to Lepechin and Pallas the same species would be found in the Arctic Ocean, ascending the rivers Ob, Lena, Kolima, &c.

5. PLECOGLOSSUS.

Plecoglossus, *Schleg. Faun. Japon. Poiss.* p. 229.

Body covered with very small scales. Cleft of the mouth wide; maxillary long. Dentition feeble: intermaxillaries with a few small, conical, pointed teeth; the teeth of the maxillaries and mandibles are lamelliform, broad, truncated, lamellated and serrated, moveable, seated in a fold of the skin; the mandibles terminate each in a small knob, and are not joined at the symphysis. The mucosa in the interior of the mouth between the terminal halves of the mandibles forms a peculiar organ, being raised into folds, with a pair of pouches in front and a single one behind. Tongue very small, with minute teeth, its apical part being toothless; palate apparently without teeth*. Pyloric appendages in great number; ova small.

Japan and Formosa.

1. Plecoglossus altivelis.

Salmo (Plecoglossus) altivelis, *Schleg. l. c.* pl. 105. fig. 1.

B. 7. D. 12. A. 16. V. 8. L. lat. 140. Vert. 64.

The height of the body is equal to, or rather less than, the length of the head, which is two-ninths of the total (without caudal); head rather compressed; snout moderately produced, with its extremity soft and slightly swollen. Eye of moderate size. The

* Schlegel mentions a band of villiform teeth on each side of the palate.

lower limb of the præoperculum very broad, Dorsal somewhat higher than long; adipose fin rather small; caudal deeply forked. Silvery, greenish on the back.

a–b. Seven and four inches long. Japan. From the Leyden Museum.
c–h. Four inches long. Formosa. From Consul Swinhoe's Collection.

6. OSMERUS.

Osmerus, sp., *Artedi, Genera*, p. 10.
Osmerus, *Cuv. Règne Anim.*

Body covered with scales of moderate size. Cleft of the mouth wide; maxillary long, extending to, or nearly to, the hind margin of the orbit. Dentition strong: intermaxillary and maxillary teeth small, much smaller than those of the mandible. Vomer with a transverse series of teeth, several of which are large, fang-like; a series of conical teeth along the palatine and pterygoid bones. Tongue with very strong fang-like teeth anteriorly, and with several longitudinal series of smaller ones posteriorly. Pectoral fins moderately developed. Pseudobranchiæ present, but rudimentary. Blind sac of the stomach of moderate length. Pyloric appendages very short, in small number; ova small.

Atlantic coasts of the temperate parts of Europe and North America; periodically ascending rivers, and frequently permanent residents of freshwaters. One species from California.

1. Osmerus eperlanus.

The Smelt. Der Stint. Närs and Slom (*Swedish*). Smelte (*Danish*). L'Éperlan.
Local names: Spirling, Sparling.
Eperlanus, *Rondelet*, ii. p. 196; *Bélon, De Aquat.* p. 288; *Aldrov.* iv. c. 12. p. 536; *Jonston*, ii. c. 2. t. 24. f. 3; *Willughby*, p. 202, tab. N. 6. f. 4; *Ray*, p. 66.
Spirinchus, *Jonston*, t. 47. f. 6; *Schonev.* p. 70, tab. 7.
Osmerus no. 1, *Artedi, Gen.* p. 10; *Synon.* p. 21, and *Spec.* p. 45 (descr. very good).
Salmo, sp., *Gronov. Zoophyl.* no. 373.
Salmo eperlanus, *L. Syst. Nat.* i. p. 511; *Bl.* i. p. 179, taf. 28. fig. 2; *Bl. Schn.* p. 410; *Donov. Brit. Fish.* ii. pl. 48; *Turton, Brit. Faun.* p. 104; *Pall. Zoogr. Ross.-As.* iii. p. 386; *Gronov. Syst. ed. Gray*, p. 152.
Trutta, sp., *Klein, Pisc. Miss.* v. p. 20. no. 12, tab. 4. figs. 2–4.
Smelt, *Penn. Brit. Zool.* iii. p. 273, pl. 61; and ed. 1812, iii. p. 416, pl. 72; *Couch, Fish. Brit. Isl.* iv. p. 276, pl. 227.
Duhamel, *Pêches*, ii. § 11, pl. 4.
Salmo eperlanus, var. marinus, *Walb. Artedi*, iii. p. 57.
—— eperlano-marinus, *Bl.* i. p. 128, taf. 28. f. 1.
Osmerus eperlanus, *Lacép.* v. p. 229; *Richards. Faun. Bor.-Amer.* iii. p. 185 (descr. taken from a British specimen); *Flem. Brit. An.* p. 181; *Ekstr. Vet. Akad. Handl.* 1834, p. 7; and *Fische v. Mörkö*, p. 191; *Jenyns, Man.* p. 429; *Yarrell, Brit. Fish.* 2nd ed. ii. p. 129, and 3rd ed. i. p. 295; *Parn. Wern. Mem.* vii. p. 312, or *Fish. Firth of Forth*, p. 152; *Nilss. Skand. Faun. Fisk.* p. 433; *Kröyer, Danm. Fisk.* iii. p. 1; *Cuv. & Val.* xxi. p. 371, pl. 620; *Siebold, Süsswasserf.* p. 271.

Salmo (Osmerus) spirinchus, *Pall. Zoogr. Ross.-As.* iii. p. 387.
Eperlanus vulgaris, *Gaimard, Voy. Isl. & Groenl. Poiss.* pl. 18. fig. 2.
Osmerus spirinchus, *Cuv. & Val.* xxi. p. 387.

B. 8. D. 11. A. 13–16. P. 11. V. 8. L. lat. 60–62.
L. transv. 7/11. Cæc. pyl. 2–6*. Vert. 60–62.

The height of the body is much less than the length of the head, which is one-fourth or two-ninths of the total (without caudal). Snout produced, much longer than the diameter of the eye; young examples have the eye comparatively larger. Vomerine teeth and anterior lingual teeth large, fang-like; posterior mandibulary teeth larger than the anterior ones, which form a double series, the inner series containing stronger teeth than the outer one. The maxillary extends to, or nearly to, the vertical from the hind margin of the orbit. Back transparent greenish, sides silvery.

Coasts and numerous freshwaters of northern and central Europe.

a. Adult. Scotland. Presented by Dr. Johnston.
b. Adult: skin. Scotland. From Mr. Parnell's Collection.
c–d. Young. Firth of Forth. From Mr. Parnell's Collection.
e. Adult. Fifeshire. Museum Leach.
f–h. Fine specimens, from 8 to 10 inches long. Conway. Presented by T. C. Eyton, Esq.
i, k–l. Adult. British.
m–r. Adult and young. Lake Wenern.
s–u. From 8 to 12 inches long. Lake Wenern. From Mr. Wheelwright's Collection.—These specimens from Lake Wenern are very lean in general appearance, and have the eye comparatively a little larger. Vert. 60.
v. Adult. Coasts of Gestrickland, Sweden. From Mr. Wheelwright's Collection.
w–x. Adult. Gefle. From Mr. Wheelwright's Collection.
y–α. Adult: bad state. Gulf of Finland.
β–δ. Young. Bohuslän. Presented by Hr. A. W. Malm.
ε. Several specimens, 3 inches long, sexually fully developed. Lake of Bjewsersk (North Russia). Cæc. pyl. 5; Vert. 60.
η. Half-grown. Haarlem. Purchased of M. Parzudaki.
ζ. Adult female: skeleton. Gestrickland. From Mr. Wheelwright's Collection.
ν. Adult: skeleton. Berlin. From Dr. A. Günther's Collection. Vert. 62.

2. Osmerus viridescens.

Salmo eperlanus, *Mitch. Lit. & Phil. Trans. New York*, i. p. 435.
Osmerus viridescens, *Lesueur, Journ. Acad. Nat. Sci. Philad.* i. p. 230; *Dekay, New York Fauna, Fishes*, p. 243, pl. 39. fig. 124 (bad); *Cuv. & Val.* xxi. p. 388.
Osmerus, sp., *Thad. Norris, in Proc. Acad. Nat. Sci. Phil.* 1861, p. 58.

Scarcely distinct from *O. operlanus*, but with a little smaller scales,

* The pyloric appendages are so short that some of them frequently become quite inconspicuous.

the number of transverse series above the lateral line being 66. The posterior mandibulary teeth not larger than the anterior ones.

Atlantic side of the United States.

a. Fine specimen, 10 inches long. Boston. Presented by B. Winstone, Esq.

b. Half-grown. New York. Purchased of Mr. Brandt.

c. Adult, in bad state. Presented by the Smithsonian Institution.

3. Osmerus thaleichthys.

Ayres, Proc. Calif. Acad. Nat. Sc. 1860, p. 62, fig. 12.

B. 8. D. 9. A. 19. P. 11. V. 8.

The length of the head is one-fourth of the total (without caudal), the height of the body one-fifth; the diameter of the eye is one-fourth of the length of the head. The maxillary reaches to the vertical from the hind margin of the eye. Teeth on the tongue largest. The origin of the dorsal fin is a little nearer to the root of the caudal than to the extremity of the snout; ventral fins entirely in advance of the dorsal. (*Ayres.*)

Common in the Bay of San Francisco.

7. THALEICHTHYS.

Thaleichthys, *Girard, U. S. Pac. R. R. Exp. Fish.* p. 325.

Body covered with small scales. Cleft of the mouth wide; maxillary long, narrowish, extending nearly to below the hind margin of the eye; lower jaw prominent. Dentition rudimentary*, only a few minute teeth being visible on the maxillary and intermaxillary; mandible, tongue, and palate apparently toothless. Pectoral fins moderately developed; anal long; caudal deeply forked. Pseudobranchiæ present, but rudimentary. Stomach with a rather long blind sac; pyloric appendages slender, in moderate number. Testes double; ova very small.

Pacific coasts of North America.

1. Thaleichthys pacificus.

The Eulachon, Oulachan.

Salmo (Mallotus?) pacificus, *Richards. Faun. Bor.-Amer.* iii. p. 226.

Thaleichthys stevensi, *Girard, U. S. Pac. R. R. Exp. Fish.* p. 325, pl. 75 (76). figs. 1–4.

—— pacificus, *Girard, Proc. Acad. Nat. Sc. Philad.* 1858, p. 225; *Cooper & Suckley, Nat. Hist. Washingt. Terr.* p. 348.

B. 8. D. 11–12. A. 21. P. 11. V. 8. L. lat. 78. C. pyl. 11. Vert. 70.

The height of the body is much less than the length of the head, which is contained four times and one-third in the total (without caudal). Snout much longer than the diameter of the eye, which is

* The teeth are so minute that bones which are described as tooth-bearing in one specimen may be toothless in another.

one-fifth of the length of the head. Ventral fins longer than pectorals, and extending nearly to the vent. Coloration uniform brownish on the back, silvery on the sides; head and sides with numerous minute brown dots.

Columbia River, Vancouver Island.

a–d. From 8 to 9 inches long. Vancouver Island. Presented by C. B. Wood, Esq., Surgeon, R.N.

8. HYPOMESUS.

Mesopus *or* Hypomesus, *Gill, Proc. Acad. Nat. Sc.* 1862, pp. 14, 15.

Body covered with thin deciduous scales of moderate size. Cleft of the mouth not wide; maxillary very thin, lamelliform, not extending to below the middle of the eye. Lower jaw slightly prominent, and received between the maxillaries. Dentition very feeble, only the intermaxillary, mandible, palatine, and pterygoid bones being provided with minute teeth; teeth of the tongue strongest, short, conical. Pectoral fins moderately developed; caudal forked. Pyloric appendages in small number.

Pacific coasts of North America, and of North-eastern Asia.

1. Hypomesus olidus.

Salmo (Osmerus) olidus, *Pallas, Zoogr. Ross.-As.* iii. p. 391*.
Argentina pretiosa, *Girard, Proc. Ac. Nat. Sc. Phil.* 1854, p. 155.
Osmerus elongatus, *Ayres, Proc. Calif. Acad. Nat. Sc.* 1854, p. 17.
—— pretiosus, *Girard, U. S. Pac. R. R. Exp. Fish.* p. 324, pl. 75 (76). fig. 5.
—— oligodon, *Kner, Denkschr. Akad. Wiss. Wien*, xxiv. 1865, taf. 4. fig. 1.

B. 7. D. 10–11. A. 16. P. 14. V. 8. L. lat. 70.

The height of the body is less than the length of the head, which is two-ninths of the total (without caudal). Snout equal in length to the diameter of the orbit, which is two-ninths of the length of the head. The maxillary extends but little beyond the front margin of the orbit. Body with a silvery band along the lateral line.

Coasts of California, Vancouver Island, and North-eastern Asia.

a. Seven inches long. Decastries Bay, Amur River. Purchased of Hr. Schmaltz.

b–d. From 7 to 8 inches long. Esquimalt Harbour. Presented by Earl Russell; collected by J. K. Lord, Esq.

Although we cannot doubt the identity of our specimens with Girard's *O. pretiosus*, the description given by Dr. Ayres of *O. elongatus* would indicate a fish more nearly allied to our European Smelt than is the present species. However, Girard, who had specimens sent by Dr. Ayres for comparison, unites them.

* This name is also adopted in the text of Brevoort's notes on some figures of Japanese fish in 'Narr. Exped. to China and Japan under Parry,' p. 278. The same author ventured to name the miserable figure, pl. 10. fig. 2, *Osmerus japonicus*.

The following description refers, perhaps, to a fish of this genus:—

Eperlanus chinensis, *Basilewsky, Nouv. Mém. Soc. Nat. Mosc.* 1855, p. 242.

"Caput cute denudatum, tenue, depressum, triangulare seu lanciforme, transparens, apice acutum, occipite dilatatum. Rictus fissus, ad oculos nigros globose prominentes attingens. Maxillæ, vomer et lingua dentibus parvulis, acutis armata. Nucha paulisper constricta. Orificium branchiale amplum ab occipite ad mentum fissum. Pinnæ pectorales breves, basi membranaceæ et propendentes; abdominales antrorsum valde admotæ; dorsalis antica 15-radiata, postrorsum remota et anali paulo interposita; postica brevissima et postremo analis longo radio respondens. Caudalis bifida. Caro sapidissima. In sinu Tschiliensi habitat. Versus Pekinum Decembre congelatus advehitur."

9. MALLOTUS.

Mallotus, *Cuv. Règne Anim.*

Body covered with minute scales, which are somewhat larger along the lateral line and along each side of the belly; in mature males these scales become elongate, lanceolate, densely tiled, with free projecting points, forming villous bands. Cleft of the mouth wide; maxillary very thin, lamelliform, extending to below the middle of the eye. Lower jaw the longer, partly received between the maxillaries. Dentition very feeble, the teeth being minute, of equal size, forming single series on the jaw-bones, vomer, palatine, and pterygoid bones; only the teeth on the tongue are somewhat larger, and disposed in an elliptical patch. Pectoral fins large, horizontal, with broad base. Pseudobranchiæ present, but rudimentary. Stomach with a long blind sac; pyloric appendages very short, in small number. Testes double; ovary single; ova very small.

Coasts of Arctic America and North-eastern Asia.

1. Mallotus villosus.

The Capelin. Fern-lodde *v.* Quette-lodde (male); Sild-lodde *v.* Rogn-lodde (fem.). *Greenlandish*: Angmaksak; Sennersulik (male with villosities), Sennersuitsut (male without). *Esquimaux*: Angmaggeuck.

Lodde, *Egede, Det gamle Grönlands nye Perlustration*, p. 50; *Crantz, Historie von Grönl.* p. 125; *Ström, Söndmör*, i. p. 393; *Pontoppidan, Første Förvög. af Norges Nat. Hist.* ii. p. 217.

Keplings, *Crantz, Fortsetz. Hist. Grönl.* p. 309.

Lodna, *Olafssen, Reis. Soröe*, pp. 358, 695, taf. 28.

Clupea villosa, *Müll. Prodr.* p. 245; *L. Gm.* iii. p. 1409.

Salmo arcticus, *Fabr. Faun. Grönl.* p. 177.

Capelan, *Duhamel, Pêches*, ii. p. 149, pl. 26; *Pennant, Arct. Zool.* iii. p. 394.

Salmo grönlandicus, *Bl.* viii. p. 99, taf. 381; *Richards. Frankl. Journ.* p. 710.

—— socialis, *Pall. Zoogr. Ross.-As.* iii. p. 389.

—— villosus, *Faber, Fische Islands*, p. 174.

Malottus villosus, *Cuv. & Val.* xxi. p. 392, pls. 622 (male) & 623 (female).
? Osmerus microdon, *Cuv. & Val.* xxi. p. 385, pl. 621 (immature).
Salmo (Mallotus) villosus, *Cuv. Règne Anim.*; *Richards. Faun. Bor.-Amer.* iii. p. 187; *Gaimard, Voy. en Isl. Poiss.* pl. 18. fig. 1.
Mallotus arcticus, *Kröyer, Danm. Fisk.* iii. p. 23.
Osmerus arcticus, *Nilss. Skand. Faun. Fisk.* p. 441.

B. 8–10. D. 13–14. A. 21–23. P. 18–20. V. 8. Cæc. pyl. 6. Vert. 68.

The height of the body is much less than the length of the head, which is contained four times and one-third in the total (without caudal). Snout longer than the diameter of the eye, which is two-ninths of the length of the head. Brownish on the back, silvery on the sides; opercles silvery, with minute brown dots.

Mature males have a band of elongate scales along the lateral line and along each side of the belly; the base and the margin of the anal fin form a convex curve, and its anterior rays are simple and rather stiff. In very old examples also the scales on the back and in the middle of the belly project beyond the skin, and the head and the rays of the paired fins are finely granulated.

Shores of Arctic North America and of Kamtschatka.

a, b, c–d, e–f, g–i. Adult males and females. Greenland.
k–l. Adult male and female. Hudson's Bay. From the Haslar Collection.
m. Adult male. Presented by the Smithsonian Institution.

10. RETROPINNA.

Retropinna, *Gill, Proc. Acad. Nat. Sc. Philad.* 1862, p. 14.
Richardsonia, *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1866, p. 53.

Body covered with scales of moderate size. Cleft of the mouth of moderate width. Small teeth, subequal in size, in single series on the jaw-bones, vomer, palatines, and pterygoids; tongue with a double series of small hooked teeth. Dorsal fin situated far backwards, behind the ventrals, above the vent; anal rather long; caudal forked; ventral six-rayed. Pseudobranchiæ present. Stomach horseshoe-shaped, without prolonged blind sac; pyloric appendages and air-bladder absent.

Freshwaters of New Zealand.

1. Retropinna richardsonii.

New Zealand Smelt.
Argentina retropinna, *Richards. Voy. Ereb. & Terr. Ichthyol.* p. 121, pl. 52. figs. 1–3 (pectoral too long).
Retropinna richardsonii, *Gill, l. c.*

B. 6. D. 11–12. A. 17–20. P. 11. V. 6. L. lat. 61.

The height of the body is less than the length of the head, which is contained four times and two-thirds in the total (without caudal). Snout shorter than the eye, the diameter of which is two-sevenths of

the length of the head. The lower jaw is the longer. Coloration uniform, with a silvery band along the side.

New Zealand.

a–f. Types of the species. From the Haslar Collection.

g–h. Three and a half inches long. Waikato River. From Mr. G. Krefft's Collection.

i. Several specimens. Presented by Vice-Admiral Sir E. Belcher.

11. COREGONUS*.

Coregonus, sp., *Artedi, Genera*, p. 9.
Coregonus, *Cuv. Règne Anim.*
Coregonus *et* Argyrosomus, *Agass. Lake Super.* p. 339.

Body covered with scales of moderate size. Cleft of the mouth small; maxillary broad, short or of moderate length, not extending behind the orbit. Teeth, if present, extremely minute and deciduous. Dorsal fin of moderate length; caudal deeply forked. Pseudobranchiæ well developed; air-bladder very large. Stomach horse-shoe-shaped; pyloric appendages extremely numerous. Ova small.

Inhabitants of the freshwaters of the northern parts of temperate Europe, Asia, and North America; many species periodically ascending from the sea, especially from the Arctic Ocean.

The species of this genus are not less numerous than those of *Salmo*, some having a very extended geographical range whilst others are confined to very limited localities. They are less subject to variation than the Trout, and therefore more easily characterized and distinguished. Hence we find that naturalists who look with distrust on the different species of *Salmo*, are quite ready to admit those of *Coregonus*. The characters which are the most reliable are the shape of the snout, the development of the maxillary, the form of the supplementary bone of the maxillary, the length of the mandible, the height of the body and tail, the position of the dorsal, and the number of scales and vertebræ. The species, which I know from autopsy, may be readily distinguished by these characters; and lengthened descriptions would be quite unnecessary, as they would repeat only the characters of the genus or refer to individuals only. However, not all previous authors have paid regard to these characters; and although but little doubt can be entertained that, in many cases, they have described distinct species, this is inferred rather from the localities where the fishes have been obtained than from the account given of them.

* The following species are so imperfectly described, that it must suffice to notice them with a few words only:—

1. *Coregonus pallasii*, Cuv. & Val. xxi. p. 483, from Russia, said to be closely allied to *Coreg. marœna* from Northern Germany, and possibly comprised by Pallas under the name of *Cor. lavaretus*. L. lat. 100.

2. A species from the Lake Pereslavle Zaleski, near Moskau, described and figured by N. Ozeretskovsky, Mém. Acad. St. Pétersb. ii. 1810, p. 376, tab. 21. It belongs to the group with prominent lower jaw.

3. *Coregonus angusticeps*, Cuv. & Val. xxi. p. 534, known from a figure only, and said to have been obtained at the Saskatchewan River.

The species may be subdivided thus:—

a. Upper jaw produced into a cutaneous appendage, p. 173.

β. Upper jaw the longer, with the upper profile descending in a curve; mouth very small, p. 176.

γ. Upper jaw obtuse, longer than, or as long as lower, with the upper profile nearly straight.

* Snout obliquely truncated, with the nose protruding.

† European species, p. 178.

† Asiatic species, p. 184.

† American species, p. 184.

* Snout vertically truncated, p. 187.

δ. Lower jaw the longer (*Argyrosomus*, Agass.).

* Body elongate, its height being less than one-third of the total length (without caudal).

† European species, p. 192.

† Asiatic species, p. 195.

† American species, p. 198.

* Body elevated, its height being one-third of the total length (without caudal), p. 199.

a. Upper jaw produced into a cutaneous appendage.

1. Coregonus oxyrhynchus.

Houting (*Holland*). Schnäpel (*Germany*).

Oxyrhynchus, *Rondel.* ii. p. 195 (part.); *Gesner*, p. 771; *Willughby*, p. 187.

Albula nobilis, *Schonev.* p. 12 (not *Gesner*).

Coregonus, sp., *Artedi, Synon.* p. 21. no. 4; *Genera*, p. 10. no. 4.

Salmo, sp., *Gronov. Zoophyl.* no. 374.

Salmo (Coregonus) oxyrinchus, *L. Syst. Nat.* p. 512; *Lacép.* v. pp. 263, 267; *Gronov. Syst.* ed. *Gray*, p. 152.

Tripteronotus hautin, *Lacép.* v. p. 48.

Salmo lavaretus, *Bl.* i. p. 163, taf. 25 (not *L.*).

—— thymallus latus, *Bl.* i. p. 170, taf. 26.

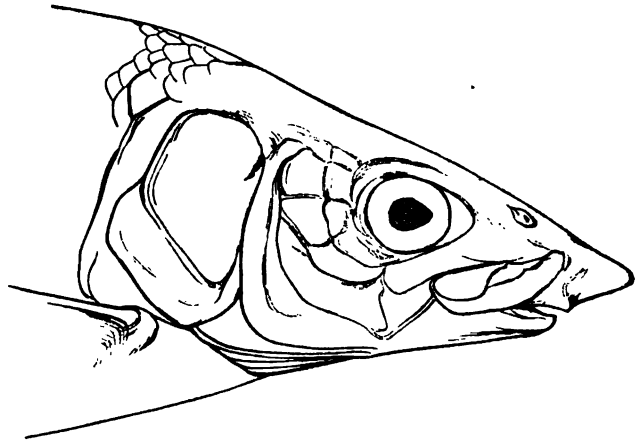
Coregonus oxyrhinchus, *Kröyer, Danm. Fisk.* p. 76 (with very bad figure).

—— oxyrhynchus, *Ekström, Fische Mörkö*, p. 198; *Cuv. & Val.* xxi. p. 488, pl. 630; *Sélys-Longch. Faune Belge*, p. 222, and in *Bull. Acad. Belg.* ix. 1842, p. 510; *Siebold, Süsswasserf.* p. 260.

B. 9. D. 14. A. 14–15. L. lat. 75–81. L. transv. $\frac{9-10}{12}$. Vert. 58.

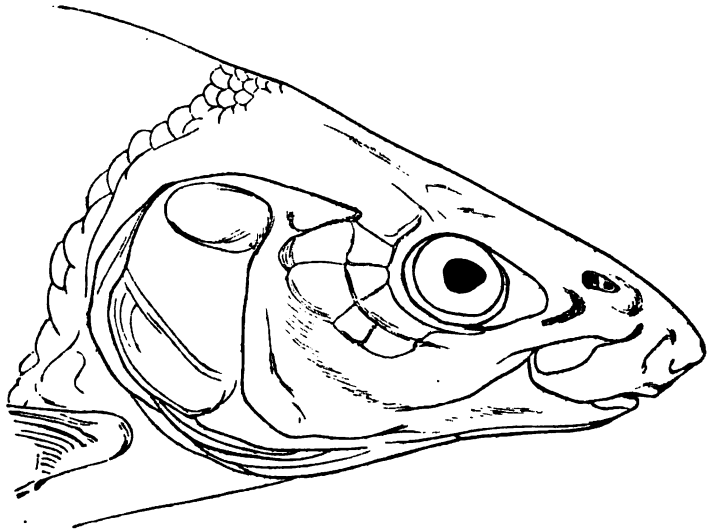
The height of the body is one-fourth or two-ninths of the total length (without caudal), the length of the head two-ninths or one-fifth. Snout produced, with the upper jaw protruding beyond the lower, and produced into a fleshy cone in adult specimens. The maxillary extends to below the adipose eyelid, or to the vertical from the front margin of the eye, and its length is contained three times and two-thirds or three times and three-fourths in that of the head. Mouth quite at the lower side of the snout. The length of the lower limb of the præoperculum is contained once and one-third or once and one-fourth in that of the posterior. Back behind the head moderately curved. Pectoral as long as the head, without snout.

Coasts and freshwaters of Holland, Germany, Denmark (and Sweden).



a, *b*, *c*. Adult. Holland.
d. Adult. River Gotha. From Mr. Lloyd's Collection.
e. Adult: skin. From Gronow's Collection.
f. Adult: skeleton. Holland.
g. Adult: skeleton. Berlin. From Dr. A. Günther's Collection.

2. Coregonus lloydii.



Näbb-sik (*Sweden*).
Coregonus oxyrhynchus, *Nilss. Prodr. Ichth. Scand.* p. 14; and *Skand.*

Faun. Fisk. p. 453 (*a.*); *L. Lloyd, Scand. Advent.* i. p. 129; *Widegren**, *Öfvers. Vet.-Akad. Förh.* xix. p. 577, t. 6. f. 2 (head).

B. 9. D. 14. A. 15. L. lat. 90. L. transv. 10/11. Cæc. pyl. ca 200. Vert. 39/23.

The height of the body is one-fourth or rather less than one-fourth of the total length (without caudal), the length of the head one-fifth or rather more than one-fifth. Snout much produced, with the upper jaw conically protruding beyond the lower, and produced into a short fleshy cone in adult specimens. The maxillary extends to the vertical from the anterior orbital fold only, and its length is contained three times and three-fourths in that of the head. The supplementary bone of the maxillary is rather narrow and elongate. Mouth quite at the lower side of the snout. The length of the mandible is somewhat more than the least depth of the tail. The length of the lower limb of the præoperculum is contained once and one-third in that of the posterior. Back behind the head strongly curved. Pectoral as long as the head without snout.

Sweden.

a, *b*. Fine specimens, male and female, 22 inches long. Lake Wenern. From Mr. Lloyd's Collection.

c–d, *e–f*. Fine specimens (half-grown). Lake Wenern. From Mr. Lloyd's Collection.

g–h. Adult: stuffed. From Mr. Yarrell's Collection.

i. Adult, male: skeleton. From Mr. Lloyd's Collection.

k. Intestines of specimen *i*.

This species will be readily distinguished from *C. oxyrhynchus* by its smaller scales and much longer snout, the maxillary extending not so far backwards as in the other species.

3. Coregonus microstomus.

Salmo microstomus, *Pall. Zoogr. Ross.-As.* iii. p. 405.

"Persimilis est *S. oxyrhincho*, sed differt ore adhuc angustiore, terminali, naso non adeo producto, corpore magis cylindraceo, squamis majoribus. Flabellis branchialibus decemlamellatis; pinnis inferis pallide rubentibus; dorsali analique decemradiatis, colore etiam dilutiore, nitide argenteo.

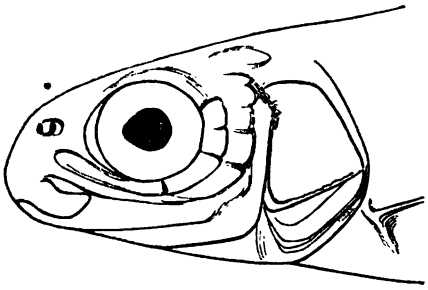
"Tantum a Lena versus orientem in fluvios adscendit e mari, amnem Lenam tantum infra ostium Kirengæ frequentans, communis dein in fluviis Indigirka, Kovyma, Anadyr, Ochota, Kutchtui et in aquis Camtschatcæ."

This species belongs, perhaps, to the following division.

* This author mentions *C. hiemalis*, Jurine, as synonymous with the Näbb-sik! and this is only one out of the numerous instances of confusion into which the same author has attempted to throw the European Salmonoids.

β. Upper jaw the longer, with the upper profile descending in a curve: mouth very small.

4. Coregonus quadrilateralis.



Specimen *c*; twice the natural size.

Richardson, Franklin's Journ. p. 714; and *Faun. Bor.-Amer.* iii. p. 204, pl. 89. fig. 1 (from a stuffed example); *Cuv. & Val.* xxi. p. 512; ? *Agass. Lake Super.* p. 351.

B. 7–8. D. 14–15. A. 13. L. lat. 86–90. L. transv. 10/12.

The height of the body is one-fifth of the total length (without caudal), the length of the head one-sixth. Snout produced, compressed, with its upper profile descending in a curve; nose projecting; the mouth at the lower side of the snout. Maxillary very short and small, its length being less than one-fifth of the length of the head; the supplementary bone of the maxillary narrow, elongate; operculum terminating in a right angle behind, conspicuously striated. Back almost straight above.

Arctic Ocean and rivers of Arctic North America. ? Lake Superior.

a, *b*. Adult, 18 inches long: stuffed. Presented by J. Ray, Esq.
c, *d–h*. Young. Port Halkett. Presented by B. R. Ross, Esq.
i?. Skin, in a bad state. Saumuss Lake, Fraser's River. Collected by Mr. Lord; presented by Earl Russell.—This specimen ought perhaps to be referred to *C. williamsoni*; but the shape of the snout is entirely destroyed; if the figure given of *C. williamsoni* is correct, it is a different species.

The typical specimen is in the Collection of Haslar Hospital.

5. Coregonus labradoricus.

Richardson, Faun. Bor.-Amer. iii. p. 206.

B. 8–9. D. 15. A. 15. V. 11–12. L. lat. 78.

Body apparently much like that of *C. quadrilateralis*; its depth is one-fifth of the length (excluding the caudal). Head small, constituting only a sixth part of the distance between the tip of the snout and end of the scales on the caudal. The orbit is exactly twice as far from the edge of the gill-cover as from the tip of the

snout. The labials are a little longer than in *C. quadrilateralis*; and their posterior pieces are of a different shape, being ovate, whereas they are acutely elliptical in the other. The under jaw measures a very little more than one-half the length of the upper surface of the head; and when the mouth is distended its tip is exactly even with the end of the snout. Jaws and palate toothless; four longitudinal rows of teeth on the tongue.

The middle between the tip of the snout and end of the scales is at the thirty-second scale of the lateral line, and opposite to the third ventral ray, or tenth dorsal one. There are eight scales between the dorsal and lateral line, and as many between the latter and the ventrals. Total length 14 inches, length of the head 2 inches.

Musquaw River (Gulf of St. Lawrence).

6. Coregonus nasus.

Salmo (Coreg.) nasus, *Pallas, Reise*, iii. p. 705.
Tschir, *Lepechin, Reise*, iii. p. 227, taf. 13.
Salmo nasutus, *Pallas, Zoogr. Ross.-As.* iii. p. 401.
[Coregonus nasutus, *Cuv. & Val.* xxi. p. 493, is evidently a very different species, as appears from the description of its snout, both jaws being said to be of equal length.]

D. 13–14. A. 15.

Sesquipedalis, vix ulnaris. Forma cyprinacea. Caput corpore crassius, vix compressum, rostro brevissimo, retuso, ante oculos convexo, gibbo. Os exiguum, cyprinaceum, læve; maxilla superior longior, quam clauso ore gibbus nasi paulo exsuperat. Nares in ipso gibbo. Periophthalmium latum. Corpus macrolepidotum, latiusculum, crassum, compresso-convexum, dorso ante pinnam obtuse angulato et per breve spatium adscendente. Color argenteo-albus, lateribus cærulescens, supra lineam lateralem fuscescens. Pinnæ omnes cærulescentes, inferæ basi albidæ; appendix ventralium triquetra, brevissima, vix squamis emergens. Longitudo descripti speciminis a summo tuberi rostri ad extrema pinnæ caudæ 1′ 6″ 0‴, capitis ad operculorum oram 3″, a summo rostro ad apicem laminarum mystacearum 7‴ (adeoque rictus brevissimus); ad oculum 7″, ad pin. pectoralem 3‴, inde ad ventralem 4″ 6‴, inde ad analem 4″ 9‴, hujus latitudo 1″ 11‴, inde ad caudam 1″ 6½‴, cujus longitudo 2″ 6‴. A summo item rostro ad pin. dorsi 7″ 6‴, hujus latitudo 2″, inde ad adiposam 3″ 11½‴, cujus latitudo 10⅓‴, inde ad pin. caudæ 1″ 6‴. Corporis latitudo summa ante pin. dorsi 4″ 3‴, crassities ibidem 2″ 1‴, capitis altitudo ad nucham 2″ 4‴, crassities 1″ 7‴. Pondus hujus trilibri minus; in fœmina 1″ 7‴, æquante fere 4 librarum. (*Pallas.*)

Arctic Sea, periodically ascending the rivers Ob, Jenisei, and Kolima.

7. Coregonus polcur.

Salmo lavaretus, var. Pidschian, *Pallas, Reise*, iii. p. 705.
Salmo polcur, *Pallas, Zoogr. Ross.-As.* iii. p. 400.
? Coregonus polcur, *Cuv. & Val.* xxxi. p. 506.

D. 13. A. 16.

Magnitudo bispithamalis. Caput breve, crassum, pingue, corpore non compressius. Rostrum obtusum, convexum, maxilla superiore longiore; frons ante oculos convexo-gibba. Os parvum, plane edentulum, cyprinaceum, lamina mystacea brevi scabritie omnino nulla. Corpus crassum, lanceolatum, compressum, dorso a capite adscendente, minus tamen, quam in *S. muksun*, et convexo. Venter magis gibbus, quam dorsum, præsertim versus pinnam ani productus in carinam compressam, cui pinna insidet. Squamæ majusculæ; linea lateralis rectissima, dorso propiore. Color cinerascente argentatus, in dorso fuscus. Pinnæ nigricantes. Longitudo a summo rostro ad finem caudæ carnosæ 1′ 2″ 10‴, capitis ad operculorum oram 2″ 9‴, distantia oculorum a summo rostro 8″, ad pinnas pectorales 2″ 9‴, inde ad ventrales 4″ 3‴, inde ad analem 4″, hujus latitudo 2″ 2‴, inde ad caudæ basin 1″ 5½‴. Item distantia pinnæ dorsi fere oppositæ ventralibus 6″ 8½‴, ejus latitudo 2″ 2‴, inde ad adiposam 3″ 10½‴, hujus basis 7‴, longitudo 11‴, corporis maxima latitudo ad pin. dorsi 3″ 10‴, crassities maxima ibidem 1″ 10‴. Altitudo capitis ad nucham 3″, crassities 1″ 6‴. Laminæ mystaceæ longitudo 6‴. (*Pallas.*)

River Ob, periodically ascending from the Arctic Sea.

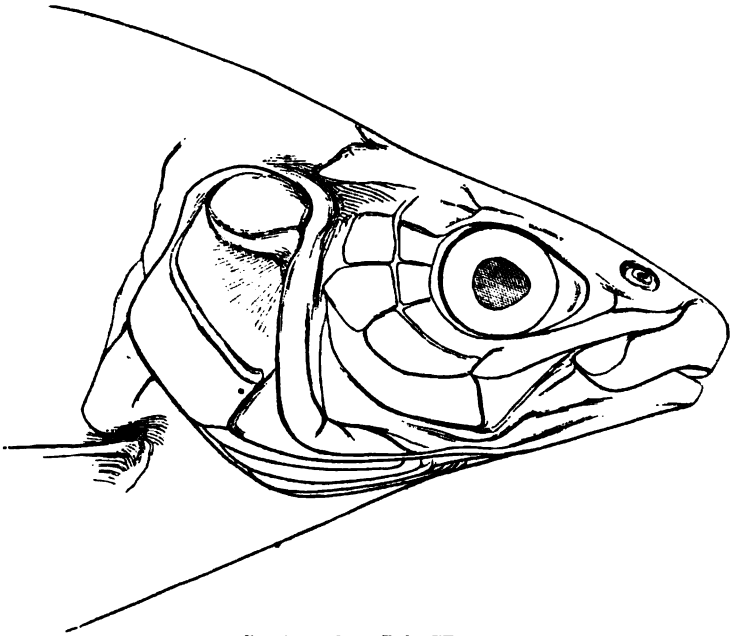
γ. Upper jaw obtuse, longer than, or as long as lower, with the upper profile nearly straight.

* *Snout obliquely truncated, with the nose protruding.*

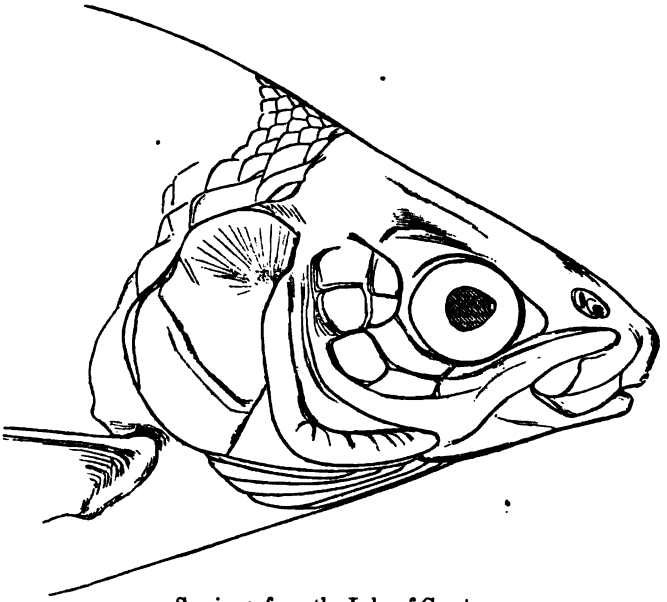
† *European species.*

8. Coregonus lavaretus.

Sik, Knubbsik (*Sweden*); Helge-Sik (*Lake Wenern*); Maræne (*Northern Prussia*); Weiss-felchen (*Lake of Constance*); Bodenrenke (*Bavaria*).
Sandfelchen, Sandgangfisch, *Mangolt, Fischbuch*, pp. 26, 40.
Lavaretus, *Rondel.* ii. p. 162; *Gesner, De Aquat.* p. 33.
Farra, *Rondel.* ii. p. 164; *Gesner, De Aquat.* p. 35.
Coregonus, *Art. Gen.* p. 10. no. 2; *Spec.* p. 37. no. 1 (*Synon.* p. 19. no. 2; this compilation of synonyms refers to various very different species).
Coregonus lavaretus, *L. Syst. Nat.* i. p. 512.
Weissfisch, Adelfisch, Weissfelchen, *Wartmann, Beschäft. Berl. Ges. ntrf. Freunde*, iii. 1777, pp. 185, 202, and 210.
Salmo marœna, *Bloch*, i. p. 172; iii. pp. 148, 164, taf. 27; *Hartm. Helv. Ichth.* p. 139; *Martens, Corr. Blatt. Würt. Landw. Verein.* 1830, xvii. p. 37.
Corregonus ferra, *Jurine, Mém. Soc. Phys. & Hist. Nat. Genève*, iii. 1825, p. 190, pl. 7.
Coregonus marœna, *Nilss. Prodr.* p. 15; *Cuv. & Val.* xxi. p. 481, pl. 629; *Siebold, Süsswasserfische*, p. 263.
—— oxyrhynchus, var. β, *Nilss. Skand. Faun. Fisk.* p. 454.



Specimen from Lake Wenern.



Specimen from the Lake of Constance.

Coregonus lavaretus, *Kröyer, Danm. Fisk.* iii. p. 55; *Widegren, Öfvers. Vet. Akad. Förhandl.* 1863, p. 583, tab. 6. f. 3, tab. 9. f. 3 (heads; synonymy erroneous).

Coregonus fera, *Cuv. & Val.* xxi. p. 472.; *Rapp, Fische des Bodensee's*, p. 18, taf. 2 (excellent figure); *Heckel, Sitzgsber. Ak. Wiss. Wien*, 1852, ix. p. 375; *Heckel & Kner, Süsswasserf.* p 238.; *Siebold, Süsswasserfische*, p. 251.

B. 9. D. 14. A. 15. L. lat. 90–94. L. transv. 11/12.
Cæc. pyl. ca. 170. Vert 60–61*.

The height of the body is contained thrice and two-thirds in the total length (without caudal), the length of the head nearly five times. Snout of moderate length, obliquely truncated, with the upper jaw projecting beyond the lower. The maxillary extends to below the anterior portion of the adipose eyelid, and its length is contained from three times and four-fifths to four times and one-third in that of the head. The supplementary bone of the maxillary is broad, short, subsemicircular. The length of the mandible equals the least depth of the tail. Back behind the head ascending in a gentle curve. Pectoral somewhat longer than the head without snout.

Great lakes of Switzerland, Tyrol, Pomerania, Mecklenburg, and Sweden.

We cannot agree with Rapp, who distinguishes the Prussian *C. marœna* from the Swiss *C. fera*, attaching specific value to characters which do not hold good even for specimens from the Lake of Constance—as the length of the fins, &c. As regards the difference in the length of the vertebræ, we refer to our remark in the foot-note. Swiss specimens have generally the maxillary a little shorter when compared with the length of the head; but this is the only visible difference, and there are Scandinavian specimens which have this bone quite as short.

a. Fine specimen, 24 inches long. Lake of Constance. Presented by Prof. v. Siebold.

b–c. Adult. Lake of Constance. From the Stuttgart Museum.

d. Adult: skin. Lake of Neuchatel.

e, f–g, h–i. Fine specimens. Lake Wenern. From Mr. Lloyd's Collection.

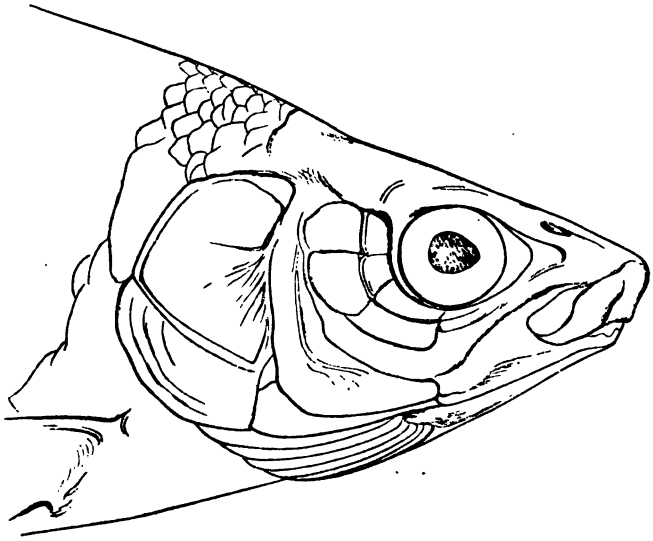
k. Many young specimens. Lake Wenern. From Mr. Lloyd's Collection.

l. Adult: skin. Lake Wenern. From Yarrell's Collection.

Pallas, Zoogr. Ross.-As. iii. p. 395, describes under the name of *Coregonus lavaretus*, a fish which periodically ascends Siberian rivers (Obi, Kolima, &c.) and is known by the name of *Schokur*. This fish is most probably distinct from the European *Lavaretus*, and appears to have a considerably longer maxillary, the length of which is contained thrice and a fourth only in that of the head.

* This number has been found by me in two specimens from the Lake of Constance (*C. fera*), in two from Lake Wenern (*C. lavaretus*), and by Rapp in a Mecklenburg specimen (*C. marœna*). It is strange that the latter, a most careful author, states 57 vertebræ for *C. fera*.

Coregonus lapponicus.



??Coregonus sikus, *Cuv. & Val.* xxi. p. 500.

B. 9. D. 15. A. 16. L. lat. 94–100. L. transv. 9/11.

The height of the body is one-fourth of the total length (without caudal), the length of the head one-fifth or rather more than one-fifth. The diameter of the eye is one-fifth of the length of the head, and two-thirds of that of the snout. Head small, moderately high; snout obliquely truncated, with the upper jaw projecting beyond the lower. Interorbital space rather convex, its width being equal to once and a third the diameter of the eye. The maxillary is short, extending to below the anterior portion of the adipose eyelid, and its length is contained four times and one-half or four times and one-third in that of the head. The supplementry bone of the maxillary is broad, short, and subsemicircular. The length of the mandible is less than the least depth of the tail. Back ascending from behind the head in a strong curve. The origin of the dorsal fin is nearer to the occiput than to the adipose fin. Pectoral longer than the head without snout.

Lapland.

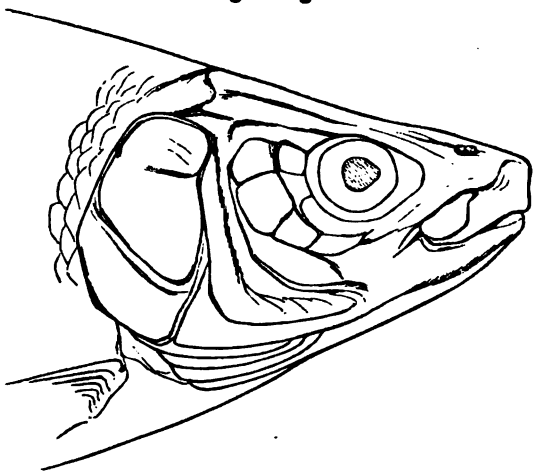
a–b. 16 inches long. From Mr. Wheelwright's Collection.

c, d. Several half-grown specimens, not in good state. Munio River. From Mr. Wheelwright's Collection.

This species is closely allied to *C. lavaretus*, but distinguished by considerably smaller and shorter mandibles.

The description of *C. sikus* given by Valenciennes is so insufficient, that nothing but the locality leads me to suppose that this fish may be identical with *C. lapponicus*.

10. Coregonus gracilis.



B. 9. D. 14. A. 15–16. L. lat. 94–100. L. transv. 11/12.

The height of the body is one-fourth (in young examples one-fifth) of the total length (without caudal), the length of the head one-fifth. The diameter of the eye is contained five times in the length of the head, and once and two-thirds in that of the head. Head small, tapering, much compressed; snout pointed, obliquely truncated or rather rounded, with the upper jaw projecting beyond the lower. Interorbital space convex, its width being equal to once and two-thirds the diameter of the eye. The maxillary is short, feeble, without longitudinal ridge, one-fourth of the length of the head; it extends to the cutaneous fold, or in young specimens to below the adipose eyelid, but never to the eye itself. The supplementary bone of the maxillary is short, broad, subsemicircular. The length of the mandible is considerably more than the least depth of the tail. Back ascending from behind the head in a slight curve. The origin of the dorsal fin is nearer to the occiput than to the adipose fin; tail rather elongate. Pectoral as long as the head without snout, somewhat shorter in young examples.

Sweden.

a. Fine specimen, 14 inches long. Sweden. Presented by Hr. A. W. Malm.

b–c. Fine specimens, 10 inches long. Gestrickland. From Mr. Wheelwright's Collection.

11. Coregonus widegreni.

Coregonus fera, *Widegren, Öfvers. Vet. Akad. Förh.* 1863, p. 64, taf. 10. figs. 1–2 (not synon.).

—— widegreni, *Malmgren, Finlands Fisk-fauna*, p. 52.

B. 9. D. 14. A. 16–17. L. lat. 90. L. transv. 10/11.

The height of the body is one-fourth of the total length (without

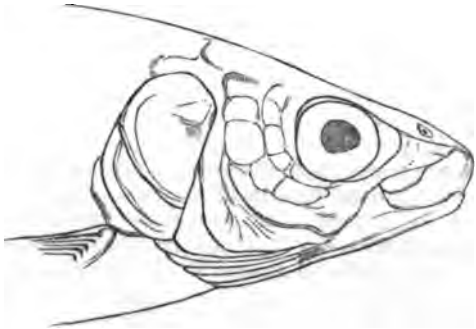
caudal); the length of the head two-ninths, or nearly one-fifth. Snout produced, obliquely truncated in front, the upper jaw being considerably longer than the lower; the maxillary extends beyond the vertical from the front margin of the eye, and its length is two-sevenths of that of the head. The supplementary bone of the maxillary is rather broad, subsemicircular. The length of the mandible is equal to the least depth of the tail. Back behind the head somewhat arched. Pectoral as long as, or somewhat longer than, the head without snout.

Lakes of Sweden and Finland.

a. Fourteen inches long. Göteborg. Presented by Hr. A. W. Malm as *C. oxyrhynchus*.

b. Thirteen inches long. White Sea?

12. Coregonus hiemalis.



Kilch, Kropffelchen (*Lake of Constance*). La Gravenche (*Lake of Geneva*).

Kirchlin, *Mangolt, Fischbuch*, p. 41.

Kropffelchen, *Wartmann, Schrift. Berl. Gesellsch. ntrf. Freund.* iv. 1783, p. 431.

Coregonus hiemalis, *Jurine, Mém. Soc. Phys. et Nat. Genève*, iii. 1825, p. 200, pl. 8 (not good); *Cuv. & Val.* xxi. p. 479; *Siebold, Süss-wasserf.* p. 254, pl. 2 (head not good; air-bladder and belly distended).

Salmo marœna media, *Hartmann, Helv. Ichthyol.* p. 145.

Coregonus acronius, *Rapp, Fische Bodens.* p. 22; *Heckel & Kner, Süsswasserf.* p. 240.

B. 8. D. 14. A. 15. L. lat. 76–87. L. transv. 9/11. Vert. 61.

The height of the body is one-fourth, or less than one-fourth, of the total length (without caudal), the length of the head two-ninths, or rather more than one-fifth; snout rather short, as long as the eye, obliquely truncated, with the upper jaw projecting beyond the lower. The maxillary extends to below the front margin of the eye, and its length is one-fourth of that of the head; the supplementary bone of the maxillary is rather narrow, of moderate length. The length of the mandible is more than the least depth of the tail. Back behind

the head ascending in a gentle curve. Very pale-coloured, the fins being but little tinged with black at their extremities.

Lakes of Switzerland and South Germany.

a. Adult. Lake of Constance. Presented by Prof. v. Siebold.
b–c, d–e. Adult. Ammer Lake. From Dr. Gemminger's Collection.
f. Adult: skeleton. Lake of Constance. From Dr. Günther's Collection.

†† *Asiatic species.*

13. Coregonus muksun.

Salmo lavaretus, var. muchsun, *Pallas, Reise*, iii. p. 705.
Salmo muksun, *Pallas, Zoogr. Ross.-As.* iii. p. 398.
? Coregonus muksun, *Cuv. & Val.* xxi. p. 494.

D. 14–16. A. 13–15.

Corpus compressum, latum; dorsum inde ab ipso capitis vertice gibbo insigni pinguissimo adscendens, ad pinnam dorsalem convexo-subcarinatum; abdomen convexum; feminis valde gibbum, unde latissimæ. Caput longiusculum, obtusum, valde compressum, corpore angustius, maxilla superiore longiore, fornicata, ad nares utrinque tuberculo gibba; lamina mystacea lata, ovali, oblonga. Maxillæ scabræ, edentulæ. Pinnæ proportione corporis minusculæ, inferæ flavescentes. P. dorsi ante æquilibrium posita. Cauda carnosa, proportione piscis parva, valde attenuata, pinna bifurca, laciniis acutissimis. Color subargenteus, dorso fuscescens. Pondus 5½ librarum. Longit. tota 1′ 10″ 6‴, capitis ad operculorum marginem 4″ 8‴, distantia oculi a summo rostro 1″, pinnarum pectoralium 3″ 10‴, inde ad ventrales 6″ 2‴, inde ad analem 5″ 4‴, ad pinn. dorsi 9″, ejus latitudo 2″ 3‴, inde ad adiposam 5″ 5‴, cujus latitudo basi 9″, inde ad p. caudæ 1″ 7‴, hujus laciniæ 3″ 3‴. Latitudo maxima perpendicularis corporis ante pin. dorsi 6″, crassities maxima versus caput 2″ 8‴. Altitudo capitis ad nucham 2″ 6‴, crassities transversa per opercula 2‴. (*Pallas.*)

Periodically (in autumn) ascending Siberian rivers from the Arctic Sea.

14. Coregonus conorhynchus.

Salmo oxyrhinchus, *Pall. Zoogr. Ross.-As.* iii. p. 403.
Coregonus conorhynchus, *Cuv. & Val.* xxi. p. 485.

D. 14. A. 14. L. lat. 88.

A Coregonus with the upper jaw more prominent than in *Cor. maræna*, from North Germany. The length of the head is one-sixth of the total. Dorsal pointed, pectoral short and rounded, ventral broad. (*Val.*)

Siberia.

††† *American species.*

15. Coregonus albus.

The Whitefish; Attihawmeg.
Salmo lavaretus, *Penn. Arct. Zool. Introd.* p. 298, & ii. p. 298 (not synon.).

Coregonus albus, *Lesueur, Journ. Acad. Sc. Philad.* i. p. 231 (not plate*); *Richards. Frankl. Journ.* p. 710, pl. 25. fig. 2 (very bad); and *Faun. Bor.-Amer.* iii. p. 195, pl. 89. fig. 2; *Dekay, Nat. Hist. New York*, iii. p. 247, pl. 76. fig. 240; *Storer, Synops.* p. 199; *Cuv. & Val.* xxi. p. 510.

Most closely allied to *C. lavaretus*, but with the maxillary extending a little further backwards.

B. 9. D. 14–15. A. 14–16. L. lat. 80–95. L. transv. 10/12.

The height of the body is contained three times and one-half or three times and two-thirds in the total length (without caudal), the length of the head four times and one-half or four times and two-thirds. Snout of moderate length, obliquely truncated, with the upper jaw projecting beyond the lower; eye considerably shorter than the snout. The maxillary extends to below the anterior edge of the eye, and its length is contained from three times and two-thirds to four times in that of the head. The supplementary bone of the maxillary is of moderate width and length, oblong. The length of the mandible equals the least depth of the tail. Back behind the head ascending in a gentle curve. Pectoral nearly as long as the head.

Lakes of North America from Lake Erie to the Arctic Sea.

a, b. Adult (22 inches long) and half-grown: stuffed. Albany River. Presented by Sir John Richardson.
c, d. Adult. Purchased.
e. Adult: stuffed. From the Collection of the Zoological Society.

16. Coregonus richardsonii.

B. 9. D. 13. A. 13. L. lat. (72–) 77–80. L. transv. 10/12.

Very similar in form to *C. albus*. Snout of moderate length, obliquely truncated, with the upper jaw projecting beyond the lower; eye shorter than the snout. The maxillary extends to the anterior edge of the eye, and its length is one-fourth of that of the head. The supplementary bone of the maxillary is short, broad, semicircular. The length of the mandible is a little less than the least depth of the tail. Pectoral longer than the head, without snout.

Arctic North America.

a. Nineteen inches long: stuffed. Presented by J. Rae, Esq.
b–c. Nineteen inches long: stuffed. From the Collection of the Zoological Society.

This species is very closely allied to *C. albus*, from which it differs

* The author of the article on *Coregonus* in Agassiz, 'Lake Superior,' believes that *C. albus*, Lesueur, was a species with prominent lower jaw, as represented on the plate. But on carefully reading through Lesueur's text, and comparing it with the figure, it appears to me to be more probable that this plate has been intended for *C. artedi*, and was misnamed *C. albus*, being published a long time after the text.

in the form of the maxillary. Beside the specimens in the British Museum, I have seen another example from the Museum at Haslar Hospital, also stuffed and 22 inches long, presented by Sir J. Richardson to the latter institution, but without indication of locality.

17. Coregonus sapidissimus.

Whitefish of Lake Superior.

Coregonus albus, *Thomps. Nat. Hist. Verm.* i. p. 143 (with a wood-cut).

—— sapidissimus, *Agass. Lake Super.* p. 344.

B. 9 (10). D. 13. A. 14. V. 12.

The height of the body is about one-third of the total length (without caudal); the length of the head one-fifth (the caudal included). Snout cut obliquely, sloping over the lower jaw. Maxillaries short, thin, elongate, attaining the anterior margin of the orbit. The anterior margin of the dorsal fin corresponds to the middle of the distance between the end of the snout and the base of the caudal.

Small specimens (not exceeding 8 inches in length) have the body somewhat lower, the greatest depth slightly exceeding the length of the head, which is one-fifth of the total, without caudal.

Lake Superior.

18. Coregonus latior.

Agassiz, Lake Superior, p. 348.

B. 8. D. 14. A. 13. V. 11.

The height of the body is one-fourth of the total length (without caudal), the length of the head one-fifth. Maxillaries broader than long (?), passing beyond the anterior margin of the orbit; snout overlapping the lower jaw, but less than in *C. sapidissimus*.

In specimens 7 inches long, the height of the body exceeds the length of the head, and is one-fourth of the total, without caudal.

Lake Superior.

19. Coregonus novæ Angliæ.

The Shad-Waiter.

Coregonus nov-angliæ, *Prescott, Sillim. Amer. Journ.* 1851, xi. p. 342.

The height of the body is contained nearly six times in the total length (with the caudal), the length of the head more than six times. The diameter of the eye is not quite one-fifth of the length of the head, and less than the extent of the snout. Snout truncated obliquely, and shut over the lower jaw, which is shorter. L. lat. about 90. (*Prescott.*)

River Winnipisseogee (New Hampshire); specimens $8\frac{8}{10}$ inches long.

A second species, *Coregonus neo-hantoniensis*, described by the same author (p. 343) and from the same locality, where it is called "Whiting," is so insufficiently characterized that we are unable to decide whether it should be introduced into the list of species.

20. Coregonus williamsoni.

Girard, Proc. Acad. Nat. Sc. Philad. 1856, p. 136; and *U. S. Pac. R. R. Exp. Fish.* p. 326, pl. 66.

B. 7. D. 14. A. 14. V. 12.

The height of the body is one-fourth of the total length (without caudal), the length of the head two-ninths; eye of moderate size, about one-fifth of the length of the head. Snout truncated, protruding beyond the lower jaw; mouth very small, the maxillary being broad and not extending to the eye (according to the figure, the maxillary would be of a very peculiar shape, being abruptly dilated at its posterior extremity*). Anterior margin of the dorsal nearer to the end of the adipose fin than to the end of the snout. Base of the adipose fin long. Scales forming eighteen longitudinal series between the dorsal and ventral fins—nine above, and eight below the lateral line. (*Gir.*)

Des Chûtes river, Oregon.

This species belongs, perhaps, to the second division of this genus.

** *Snout vertically truncated.*

21. Coregonus wartmanni.

Blau-felchen, Gangfisch (*Lake of Constance*); Renke (*Bavaria*).
Mangolt, *Fischbuch*, pp. 25, 40; *Wartmann, Beschäft. Berl. Ges. Naturf. Freund.* iii. 1777, p. 184.
Lavaretus, *Bellon.* p. 284; *Gesner, De Aquat.* p. 34 *et seq.*
Bezola, *Rondel.* ii. p. 163; *Gesner, De Aquat.* p. 35.
Albula parva, *Gesner, De Aquat.* p. 38.
Coregonus, sp. 2, *Artedi, Synon.* p. 19. var. *α*, *γ*, & *δ*.
Salmo wartmanni, *Bloch, Fische Deutschl.* iii. p. 165, taf. 105; *Schrank, Faun. Boica*, p. 324; *Rapp, Fische d. Bodensee's*, p. 12, taf. 1 (excellent figure); *Heckel, Sitzgsb. Akad. Wiss. Wien*, 1851, viii. p. 375; *Heck. & Kner, Süsswasserf.* p. 235; *Siebold, Süsswasserf.* p. 243.
Salmo renke, *Schrank, Schrift. Berl. Ges. naturf. Freund.* iv. 1783, p. 427.
Salmo marsenula, albula, wartmanni, *Hartmann, Helvet. Ichth.* pp. 148, 152 & 154.
Coregonus lavaretus, *Cuv. & Val.* xxi. p. 466, pl. 627.
—— palea, *Cuv. & Val.* xxi. p. 477, pl. 628 (bad); *Heckel, Sitzgsber. Akad. Wiss. Wien*, 1851, viii. p. 375.
—— reisingeri, *Cuv. & Val.* xxi. p. 496.
—— nilssoni, *Cuv. & Val.* xxi. p. 497 (e. p.).

B. 9. D. 14. A. 14–15. L. lat. 80–92. L. transv. 10/11. Vert. 59–60†.

The height of the body is rather more than the length of the head, which is contained four times and one-half or four times and three-fourths in the total (without caudal). Snout but little longer than the eye, vertically truncated, with the jaws equal in front. The maxillary extends to, or a little beyond, the vertical from the front margin of the eye, and its length is one-fourth or somewhat more

* I suppose this to be an error in the drawing.

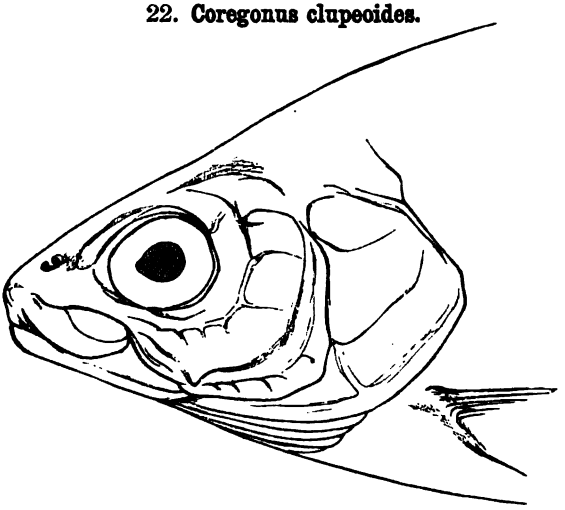
† 57 according to Rapp, but we believe that this author has not counted the last vertebræ between the basal bones of the caudal fin.

than one-fourth of that of the head. The supplementary bone of the maxillary is of moderate width and length. The length of the mandible is considerably more than the least depth of the tail. Back behind the head ascending in a very gentle curve. Pectoral equal to, or longer than, the head, without snout.

Great lakes of Switzerland and Tyrol.

a, b. Adult. Lake of Constance.
c–e. Adult and half-grown. Würm-See (Bavaria). From Dr. Gemminger's Collection.
f–g. Adult. Lake of Neuchatel. Presented by P. L. Sclater, Esq.
h–l. Adult and half-grown. Lake of Neuchatel. From Prof. E. Agassiz's Collection.
m–p. Half-grown. Switzerland? Presented by Dr. E. Rüppell.
q. Skull. Lake of Constance. From Dr. A. Günther's Collection.

22. Coregonus clupeoides.



Specimen *c*.

Gwyniad (*Lake of Bala*); Schelly (*Ullswater*); Powen (*Loch Lomond*).
Guiniad, *Will.* p. 183; *Pennant, Brit. Zool.* iii. p. 276, pl. 62, and ed. 1812, iii. p. 419, pl. 73 (not synon.).
Coregonus clupeoides, *Lacép.* v. p. 698; *White, Catal. Brit. Fish.* p. 81.
Coregonus lacepedei, *Parnell, Ann. Nat. Hist.* 1838, i. p. 162 (c. fig. med.); *Yarrell, Brit. Fish.* 2nd ed. ii. p. 151.
Coregonus microcephalus, *Parnell, l. c.* p. 163 (c. fig. med.).
Salmo lavaretus, *Turton, Brit. Faun.* p. 104.
Coregonus lavaretus, *Flem. Brit. An.* p. 182; *Jenyns, Man.* p. 431; *Yarrell, Brit. Fish.* 2nd ed. ii. p. 142.
Coregonus pennantii, *Cuv. & Val.* xxi. p. 507; *Yarr. Brit. Fish.* 3rd edit. i. p. 310.

Coregonus cepedii, *Cuv. & Val.* xxi. p. 503; *Yarr. Brit. Fish.* 3rd edit. i. p. 314.

B. 9. D. 14–15. A. 13–16. L. lat. 73–90. L. transv. 9/11. Cæc. pyl. 120. Vert. 38/20.

Closely allied to *C. wartmanni*. The height of the body is one-fourth of the total length (without caudal), the length of the head two-ninths. Snout as long as the eye, truncated, with the upper jaw but little longer than the lower. The maxillary extends somewhat beyond the vertical from the front margin of the eye, and its length is one-fourth of that of the head; the supplementary bone is rather broad, subsemicircular. The length of the mandible is more than the least depth of the tail. Back behind the head arched and ascending in a strongish curve. Pectoral longer than the head (without snout). Fins blackish or black; head and base of the caudal sometimes with small blackish dots.

Lakes of Great Britain.

a. Numerous skins. Loch Lomond. From Mr. Parnell's Collection.
b. Adult: skin. Loch Lomond. From Mr. Parnell's Collection. Type of *Coregonus microcephalus*, Parnell.
c–d. Fine specimens. Haweswater, Cumberland. Presented by Dr. A. Günther.
e. Adult: skin. Cumberland. From Mr. Yarrell's Collection.
f–g. Adult. Ullswater, Westmoreland. Presented by W. T. Tegetmeier, Esq.
h. Adult. Ullswater, Westmoreland. Presented by the Rev. R. Everest.
i. Adult.
k. Adult. Bala Lake*. Presented by Dr. A. Günther.
l. Adult: skin. Bala Lake. Presented by Sir W. Jardine.
m. Adult female: skeleton. Ullswater. Presented by W. T. Tegetmeier, Esq.

23. Coregonus maxillaris.

Löf-sik, *Lloyd, Scand. Advent.* i. p. 131 (fig. not good).

B. 9. D. 13. A. (14–)16. L. lat. 87(–96)†. L. transv. 11/11.

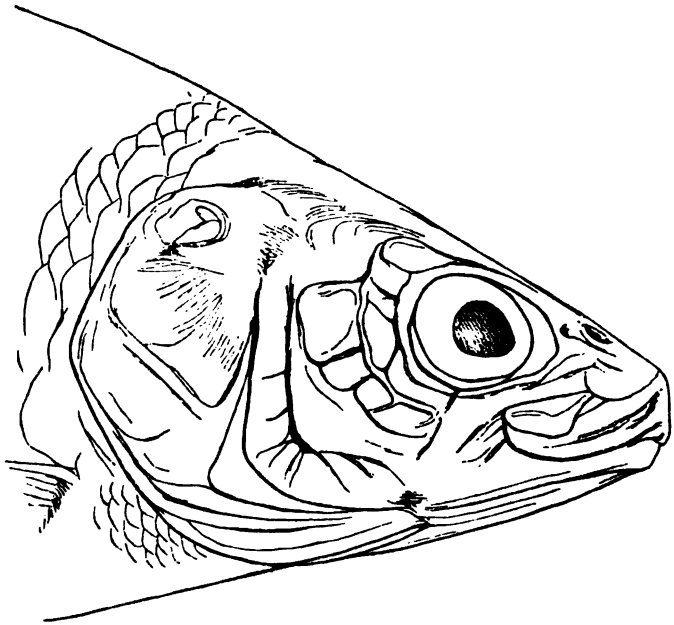
The height of the body is two-sevenths of the total length (without caudal), the length of the head two-ninths; snout longer than the diameter of the eye, which is nearly one-fifth of the length of the head; it is rather broad and vertically truncated in front, with the lower jaw a little shorter than the upper. Interorbital space flattish, its width being equal to once and two-thirds the diameter of the eye. Maxillary well developed, strong, two-sevenths of the length of the head, with a longitudinal ridge, extending somewhat beyond the vertical from the front margin of the eye; supplementary bone

* This locality is described by Valenciennes (p. 509) as "ce lac de Fer, le Llyd-Thid," which probably ought to be interpreted Llyn Tegid, the Welsh name meaning a "Fair Lake."

† The numbers in brackets are taken from the second dried specimen.

of the maxillary broad, subsemicircular. The length of the mandible is more than the least depth of the tail. Back arched. The origin of the dorsal fin is midway between the occiput and the adipose fin. Pectoral as long as, or rather longer than, the head without snout.

Lake Wenern.



a. Fine female specimen, 18 inches long. Lake Wenern. Presented by L. Lloyd, Esq.

b. Skin, 19 inches long. Lake Wenern. From Mr. Yarrell's Collection.

This species agrees in most characters with *C. wartmanni*, but has the body much more elevated. Widegren and Malmgren appear to have confounded it with *C. fera* and *C. widegreni*, which have the snout obliquely, and not vertically truncated.

24. Coregonus humilis.

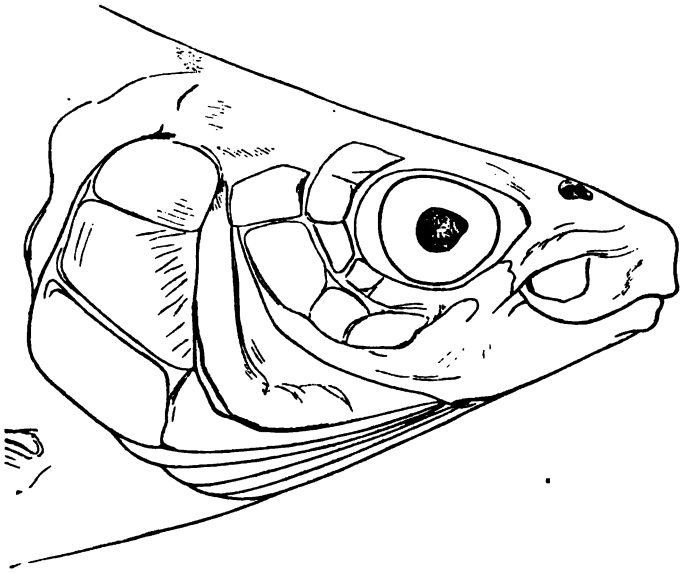
Mårtensmess-sik, *Lloyd, Scand. Advent.* i. p. 133 (c. fig. med.).

B. 8–9. D. 13. A. 15. L. lat. 90–96. L. transv. 10/11. Vert. 60.

The height of the body is one-fourth of the total length (without caudal), the length of the head is two-ninths. The diameter of the eye is one-fifth of the length of the head, and two-thirds of that of the snout. Head rather low, snout somewhat produced, vertically truncated in front, with the lower jaw the shorter. Interorbital space flattish, its width being equal to once and two-thirds the

diameter of the eye. Maxillary short, two-ninths of the length of the head, without longitudinal ridge, extending to below the adipose eyelid, but not to the eye itself; supplementary bone of the maxillary broad, subsemicircular. The length of the mandible equals the least depth of the tail. Back slightly arched. The origin of the dorsal fin is a little nearer to the occiput than to the adipose fin. Pectoral longer than the head, without snout. Male with numerous small blackish dots on the head and the dorsal fin.

Lake Wenern.



a. Fine male specimen, 12 inches long. From Mr. L. Lloyd's Collection.
b. Skin, 18 inches long. From Yarrell's Collection.
c–d. Adult, 15 inches long. From Mr. L. Lloyd's Collection.

25. Coregonus megalops.

Widegren, *Öfvers. Vet. Akad. Förh.* 1863, p. 589, taf. 11. fig. 15.

D. 14. A. 16. V. 11. L. lat. 92.

The height of the body is nearly equal to the length of the head, and one-fifth of the total (without caudal). Jaws equal in length; snout truncated, shorter than the eye, the diameter of which is not much more than one-third of the length of the head. The distance from the end of the snout to the hind margin of the orbit equals that from its front margin to the præoperculum. The maxillary extends to the vertical from the front margin of the eye.

Lakes of Northern Sweden.

26. Coregonus nilssoni.

Blåsik.

? Coregonus nilssoni, *Cuv. & Val.* xxi. p. 497, pl. 631.—Rapp has shown (Bodensee, Fische, p. 17) that Valenciennes confounded under this name a *Coregonus* from the Lake of Constance (*C. wartmanni*) with a Scandinavian fish. It appears to us even doubtful whether the entire description and the figure are not taken from the Swiss species which had been sent to the Paris Museum by Georg von Martens (not Mertens).

Coregonus nilssonii, *Nilss. Skand. Faun.* iv. p. 460; *Widegren, Öfvers. Vet. Akad. Förh.* 1863, p. 587, taf. 10. fig. 3 (head).

B. 8–9. D. 14–15. A. 15. L. lat. 85–88.

Head small, tapering, contained five times and a half in the total length (with the caudal) (more than six times, *Widegren*); the depth of the body equals the length of the head. Snout truncated, with the jaws nearly equal in length, rather longer than the eye, the diameter of which is one-fourth or one-fifth of the length of the head. The maxillary extends to the vertical from the front margin of the eye; the length of the mandible is more than the least depth of the tail [and equal to the distance between eye and posterior margin of operculum ?].

The typical specimens were from Lake Ring, near Lund in Sweden; but the species is said to occur in several other lakes of Sweden and Lapland; it attains to a length of from 10 to 12 inches.

δ. Lower jaw the longer (Argyrosomus, *Agass.*).

* *Body elongate, its height being less than one-third of the total length (without caudal).*

† *European species.*

27. Coregonus albula.

Siklöja, Smasik, Stint, Rabboxe, Sil (*Sweden*); Lakesild, Skadd, Wemme (*Norway*).

Coregonus, *Artedi, Gen.* p. 9. no. 1; *Synon.* p. 20. no. 1; *Spec.* p. 40. no. 2.

Salmo (Coregonus) albula, *L. Syst. Nat.* i. p. 512; and *Faun. Suec.* p. 353; *Retz. Fauna*, p. 349; *Pall. Zoogr.* iii. p. 413.

Salmo marænula, *Bloch, Fische Deutschl.* i. p. 176, taf. 28. f. 3.

Le Wemme, *Ascan.* t. 29.

Siklöja, *Ekstr. Vet. Akad. Handl.* 1834, p. 16.

Coregonus albula, *Ekstr. Fische Mörkö*, p. 203; *Cuv. & Val.* xxi. p. 520 (descr. part.): pl. 633 appears to have been taken from a Swedish example; at all events, the figure does not represent the Vendace of Scotland.

Coregonus albula, *Nilss. Skand. Faun. Fisk.* p. 465; *Lloyd, Skand. Advent.* i. p. 135; *Kröyer, Danm. Fisk.* iii. p. 93; *Siebold, Süsswasserf.* p. 265; *Malmgren, Finl. Fiskfauna*, p. 55.

Vettern's Siklöja, *Widegren, Öfvers. Vet. Akad. Förhandl.* 1863, p. 591, taf. 9. figs. 1–2.

D. 12–13. A. 15–16. L. lat. 75–84. L. transv. 9/10. Vert. 57–58.

The distance of the occiput from the front margin of the upper jaw is one-half, or a little more than one-half, of its distance from the

origin of the dorsal fin. Eye as long or nearly as long as the snout, and about one-fourth of the length of the head. Length of the mandible much more than the least depth of the tail. There are seven longitudinal series of scales between the lateral line and the root of the ventral fin.

North of continental Europe.

Var. *α. albula.* Eye as long as the snout, one-fourth or a little more than one-fourth of the length of the head; pectoral as long as the head (without snout), its length being two-thirteenths of the total (without caudal). The height of the body is one-sixth or rather more than one-sixth of the total length (without caudal) in males, and rather more than one-fifth in females; the length of the head is two-ninths, or somewhat more than one-fifth. Vert. 57. Lake Wenern.

a. Many adult (6 inches) and half-grown specimens. From Mr. L. Lloyd's Collection.

Var. *β. norvegica.* Eye somewhat shorter than the snout, and a little less than one-fourth of the length of the head; pectoral rather longer than the head (without snout), its length being one-fifth of the total (without caudal). The height of the body is rather more than one-fifth of the total length (without caudal); the length of the head is two-ninths. Vert. 57. Norway.

b–e. Adult (7 inches) and half-grown. Presented by Professor Esmark.

Var. *γ. marœnula.* Eye as long as the snout, one-fourth or somewhat more than one-fourth of the length of the head; pectoral as long as the head (without snout), its length being two-elevenths of the total (without caudal). The height of the body is contained four times and two-thirds in the total (without caudal), the length of the head four times. Vert. 58. North Germany.

f–h. Adult, 8 inches long. From the Berlin Museum.
i. Several specimens. Schwerin Lake. From the Berlin Museum.
k. Adult, skeleton. From Dr. A. Günther's Collection.

Var. *δ. finnica.* Appears to be very near to the preceding variety, but the length of the head is two-ninths of the total (without caudal). Finland.

l–m. Adult (7 inches long), in a bad state. Gulf of Finland.

28. Coregonus vimba.

Sik-wimma.

Anima-wimma, *Linn. Vestg. Resa*, p. 231.
Coregonus vimba, *L. Syst. Nat.* i. p. 512.
—— wimba, *Nilss. Prodr.* p. 17, & *Faun. Suec. Fisk.* p. 462 [*Cuv. & Val.* xxi. p. 515, pl. 632. This description is apparently taken from a Russian species, different from *C. vimba*; the figure, at all events, does not represent the Swedish *C. vimba*].

D. 12. A. 14–16. L. lat. 80. L. transv. 9/10. Vert. 58.

The height of the body is rather more than the length of the head,

which is two-ninths of the total (without caudal fin). The distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. The diameter of the eye is as long as the snout, and a quarter or a little less than a quarter of the length of the head; length of the mandible much more than the least depth of the tail. Pectoral as long as the head (without snout). There are seven longitudinal series of scales between the lateral line and the root of the ventral fin.

Sweden.

a. Adult. Bahuslän? Presented by Hr. A. W. Malm.
b–d. Adult. Lake Wenern. From Mr. Wheelwright's Collection.
e. Adult: skin. Sweden. From Mr. Yarrell's Collection.

29. Coregonus vandesius.

The Vendace.
Vandesius, *Sibbald, Scot. Ill.* p. 26.
Vangis et Juvangis, *Penn. Brit. Zool.* iii. p. 420.
Coregonus marænula, *Jardine in Edinb. Journ. Nat. & Geog. Sc.* iii. p. 4, pl. 1; *Jenyns, Man.* p. 432.
Vendace, *Knox, Trans. Roy. Soc. Ed.* xii. p. 503; *Couch, Brit. Fish.* iv. p. 289, pl. 230.
Coregonus vandesius, *Richards. Faun. Bor.-Amer.* iii. p. 213.
Coregonus willughbii, *Jardine, Ill. Scot. Salm.* pl. 6; *Yarr. Brit. Fish,* 2nd ed. ii. p. 146.
Coregonus albula, part., *Cuv. & Val.* xxi. p. 520.
Coregonus albula, *White, Catal. Brit. Fish.* p. 81; *Yarr. Brit. Fish.* 3rd edit. iii. p. 324.

D. 11. A. 13. V. 11. L. lat. 68–71. L. transv. 8/10. Vert. 56.

The height of the body is one-fourth of the total length (without caudal); the length of the head is two-ninths. The distance of the occiput from the front margin of the upper jaw is one-half of its distance from the origin of the dorsal fin. Eye large, considerably longer than the snout, and two-sevenths of the length of the head. Length of the mandible more than the least depth of the tail. Pectoral a little longer than the head (without snout). There are seven longitudinal series of scales between the lateral line and the root of the ventral fin.

Dumfriesshire.

a–c. Adult (7½ inches). Loch Maben. Presented by Sir W. Jardine.
d, e, f, g–h, i–l. Adult (8 inches) and half-grown. Loch Maben.
m–o. Adult: skins. From Mr. Parnell's Collection.

30. Coregonus pollan.

The Pollan.
Coregonus pollan, *Thompson, Proc. Zool. Soc.* 1835, p. 77; *Mag. Zool. & Bot.* i. p. 247; and *Nat. Hist. Ireland* iv. p. 168; *Jenyns, Man.* p. 432; *Yarr. Brit. Fish.* 2nd edit. ii. p. 156, and 3rd edit. i. p. 168; *Cuv. & Val.* xxi. p. 502; *Couch, Brit. Fish.* iv. p. 292. pl. 231.

D. 13–14. A. 12–13. V. 12. L. lat. 80–86. L. transv. 9/11. Vert. 60–61.

The height of the body equals the length of the head, and is two-

ninths or one-fifth of the total (without caudal). The distance of the occiput from the front margin of the upper jaw is less than one-half, very rarely one-half, of its distance from the origin of the dorsal fin. The diameter of the eye is as long as the snout, and one-quarter or a little less than one-quarter of the length of the head; length of the mandible more than the least depth of the tail. Pectoral as long as the head, without snout. There are eight longitudinal series of scales between the lateral line and the root of the ventral fin.

Ireland.

a–b. Fine adult specimens (10 and 11 inches long). Ireland. Purchased.

c–d. Many adult specimens. Lough Neagh. Presented by R. Patterson, Esq. and Prof. W. Thomson.

e–h, *i*. Adult; skins. Lough Neagh. From Messrs. Parnell's and Yarrell's Collection.

k–n. Adult. Purchased of Mr. Stevens.

31. Coregonus lucius.

? Coregonus sardinella, *Cuv. & Val.* xxi. p. 517.
—— clupeoides, *Lilljeborg, Vet. Akad. Handl.* 1850 (1851), p. 304; *Nilss. Skand. Faun. Fisk.* p. 466.
—— lucius, *Nilss. l. c.*

B. 9. D. 14. A. 18. V. 11. L. lat. 110–112.

The height of the body is nearly one-sixth of the total length, the length of the head two-ninths. Maxillary long, extending to below the middle of the eye; mandible very long, prominent. (*Nilss.*)

A migratory species periodically ascending rivers east from the North Cape.

† *Asiatic species.*

32. Coregonus merkii.

Salmo clupeoides, *Pall. Zoogr. Ross.-As.* iii. p. 410 (not Lacép.).

D. 12. A. 16. V. 12. L. lat. 88. L. transv. 9/11.

Apparently allied to *C. pollan*. The height of the body is scarcely more than the length of the head, which is one-fifth of the total (without caudal). The distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. Eye rather large. Maxillary long, not much more than one-third of the length of the head, with a longitudinal ridge. The length of the mandible is rather more than the least depth of the tail. Pectoral longer than the head, without snout. There are nine longitudinal series of scales between the lateral line and the roof of the ventral fin.

A migratory species, periodically ascending the Kolima and other Siberian rivers.

These characters are taken from an example from Pallas's Collection, now in the Berlin Museum, and 15 inches long. Valenciennes,

who also examined this specimen, has identified it with specimens from the Irtish, naming it *C. sardinella*. But as he describes the scales as very small, it is more probable that those Irtish specimens are identical with *Coregonus clupeoides* of Nilsson.

33. Coregonus omul.

Salmo autumnalis, *Pall. Reise*, iii. p. 705.
Omul, *Lepechin, Reise*, iii. p. 228, taf. 14. f. 1 (bad).
Salmo migratorius, *Georg. Reise*, i. p. 182.
—— omul, *Pall. Zoogr. Ross.-As.* iii. p. 406.
Coregonus omul, *Cuv. & Val.* xxi. p. 528.

B. 9. D. 13. A. 15.

Facies Clupeæ. Bispithamalem longitudinem raro excedit. Caput parvum, conicum, convexum, rostroque non compressum; os plane edentulum, maxilla superiore planiuscule fornicata, lamina mystacea oblonga, majuscula; inferiore multo longiore. Opercula branch. rotundata; oculi magni. Corpus crassiusculum, pingue, convexo-compressum, dorso quoque nisi prope pinnam, ubi obsoletissime carinatum. Squamæ majusculæ præsertim infra lineam lateralem. Color albo-argenteus, supra lineam lateralem demum cærulescens, in summo tantum dorso fuscidus; caput etiam, præter verticem fuscum, totum albet. Pinna dorsalis ventralibus dimidio anterior, fusca, ventrales cum appendice magna, triquetra, lata, fere dimidium pinnæ æquante. Cauda bifurca, lacinia superiore majore, fusca.— Maximum quod vidi specimen e mari glaciali long. 22 pollicum, pondere erat 6½ librarum, ovis tamen non grave, sed pinguissimum, vulgo marini pariter et baïcalenses ad pondus trium librarum accedunt, longitudine tota 1′ 4″ 6‴, capitis ad operculorum marginem 2′ 8½‴, a summo maxillæ arcu ad oculos 7‴, ad finem laminæ mystaceæ 10‴, ad pinnas pectorales 1″ 7⅔‴, inde ad ventrales 4″ 10½‴, quarum appendices 9‴, inde ad pin. ani 3″ 7½‴, hujus latitudo 1″ 6½‴, inde ad caudam 1″ 3½‴. A summo item oris margine ad pin. dorsi 6″ 9‴, ejus latitudo 1″ 9‴, inde ad adiposam 3″ 8½‴, ejusque latitudo basi 5‴, inde ad initium caudæ 1″ 4‴, long. laciniarum caudæ 2″ 5‴. Latitudo summa corporis ad pin. dorsi 3″ 7‴, crassities 2″, altitudo capitis ad nucham 1″ 11‴, crassities 1″ 8‴. (*Pallas.*)

A migratory species, periodically ascending Siberian rivers from the Arctic Ocean.

34. Coregonus syrok.

Salmo wimba, *Pall. Zoogr. Ross.-As.* iii. p. 409 (not L.).
Coregonus syrok, *Cuv. & Val.* xxi. p. 499.

D. 11–14. A. 16–17.

Magnitudo pedalis. Caput cyprinaceum: os laxius, quam in *S. polcur*, maxilla inferiore clauso ore subbreviore, eodemve hiante paulo longiore. Os et laminæ mystaceæ plane edentula; hæ margine inferiore ad apicem sinuatæ. Vertex capitis compressi convexus, æqualiter in rostrum declivis. Corpus forma Rutili, squamis majusculis, minoribus tamen quam Lavareto. Color argentatus, supra

lineam lateralem cærulescens, dorso fuscus. Pinnæ dilute fuscæ, dorsales et ventrales (fere anteriores) nigriores. Cauda profunde bifurca, lacinia inferiore angustiore. Longitudo totius piscis (solita) 12″ 9‴, capitis cum operculis 2″ 1½‴, a summo rostro ad oculos 6¼‴ ad pin. pectorales 2″ 3½‴, inde ad ventrales 2″ 10‴, longitudo appendicum 4½‴, hinc ad analem 2″ 11‴, hujus latitudo 1″ 10‴, a rostro ad pin. dorsi 5″ 2‴, hujus latitudo 1″ 5‴, inde ad adiposam 3″, quæ basi lata fere 5‴, ab eaque ad pin. caudæ 1″ 2‴. Maxima latitudo corporis ad pin. dorsi 3″ 1‴, crassities 1″ 5‴, capitis altitudo ad nucham 1″ 7⅓‴, ejudem crassities 1″ 1½‴. (*Pallas.*)

Siberia.

35. Coregonus tugun.

Salmo tugun, *Pallas, Zoogr. Ross.-As.* iii. p. 414.
Coregonus tugun, *Cuv. & Val.* xxi. p. 519.

D. 12. A. 16.

Digitali raro major, sed dantur ad staturam 5 et 6 pollicum. Forma, colore et magnitudine Cyprino leucisco similis, quorum et promiscue capitur. Dorso minus convexo, quam Albula, imo rectiore quam abdomen. Caput corpore compressius, supra a nucha ad rostrum angulo longitudinali obsolete carinatum; rostrum breviter conicum, obtusiusculum, maxilla inferiore paulo longiore, utraque edentula. Oculi magni. Corpus squamis, ut in Albula, tenuibus, argenteis; dorsum fuscescens. Cauda profunde bifurca, lobis subæqualibus. Longitudo in descripto 3″ 7‴, capitis 8‴, ad pin. pectorales 8‴, inde ad ventralem 10¼‴, inde ad p. ani 8½‴, hujus latitudo 6‴, inde ad pinnam caudæ 3⅔‴, caudæ laciniæ 7‴, ad pinnam dorsi 1″ 5‴, ejus extensio 5‴, inde ad adiposam 8‴, a qua distat initium pin. caudæ 6‴, latitudo summa corporis ante p. dorsi 7⅓‴, crassities vix ultra 4‴. (*Pallas.*)

Siberia.

36. Coregonus rudolphianus.

Cuv. & Val. xxi. p. 531.

D. 13. A. 15. V. 13. L. lat. 75. L. transv. 9/11.

The height of the body is rather more than the length of the head, which is one-fifth of the total length (without caudal); head low, longish. The distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. The length of the maxillary is contained thrice and one-third in that of the head; that of the mandible equals the least depth of the tail. Pectoral as long as the head, without snout. There are eight longitudinal series of scales between the lateral line and the root of the ventral fin.

Probably from Siberia.

I have examined the typical specimen from Pallas's collection in the Berlin Museum, a skin 15½ inches long, in a bad state of preservation, which ought never to have been used for introducing an almost nominal species into the system.

† *American species.*

37. Coregonus clupeiformis.

Shad-Salmon; Freshwater-Herring.
Salmo clupeiformis, *Mitch. Amer. Month. Mag.* 1818, ii. p. 321.
Coregonus clupeiformis, *Dekay, New York Fauna, Fish.* p. 248, pl. 60. fig. 198; *Cuv. & Val.* xxi. p. 523; *Agassiz, Lake Super.* p. 339.
—— artedi, *Lesueur, Journ. Ac. Sc. Philad.* i. p. 231 (with a plate, misnamed *C. albus*); cop. by *Richards. Faun. Bor.-Amer.* iii. p. 203; *Kirtland, Bost. Journ. Nat. Hist.* 1842, iv. p. 231; *Storer, Synopsis,* p. 199.

D. 12. A. 14. L. lat. 76–77. D. transv. 8/10.

The height of the body equals the length of the head, which is two-ninths of the total (without caudal); the distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. The diameter of the eye is less than the length of the snout (which is pointed), or nearly one-fifth of the length of the head; maxillary long and broad, its length being contained thrice and one-third in that of the head. Length of the mandible much more than the least depth of the tail. Pectoral shorter than the head, without snout. There are seven longitudinal series of scales between the lateral line and the root of the ventral fin. Appendage of the ventral fin half as long as the fin.

Lakes Erie and Ontario.

a–h. Adult (11–13 inches long): skins. Ontario. From Dr. Parnell's Collection.
i. Adult. Purchased of Hr. Brandt.

38. Coregonus lucidus.

Herring-Salmon.
Salmo (Coregonus) lucidus, *Richards. Faun. Bor.-Amer.* iii. p. 207, pl. 90. fig. 1.

D. 14. A. 14. L. lat. 83. L. transv. 10/12.

The height of the body is a little more than the length of the head, which is one-fifth of the total (without caudal); the distance of the occiput from the front margin of the upper jaw is contained twice and two-thirds in its distance from the origin of the dorsal fin. The diameter of the eye is less than the length of the snout (which is pointed), or one-fifth of the length of the head; maxillary long and broad, its length being two-sevenths of that of the head. Length of the mandible much more than the least depth of the tail. There are eight longitudinal series of scales between the lateral line and the root of the ventral fin. Appendage of the ventral fin more than half as long as the fin.

Great Bear Lake.

I consider this species to be distinct from *C. clupeiformis*; the characters are taken from the typical specimen in the Haslar Collection.

39. Coregonus harengus.

Salmo (Coregonus) harengus, *Richards. Faun. Bor.-Amer.* iii. p. 210, pl. 80. f. 2.

? Coregonus albus, *Agassiz, Lake Superior*, p. 342.

D. 12. A. 13. L. lat. 74 (–84, Richards.). L. transv. 9/12.

The height of the body is rather more than the length of the head, which is two-ninths of the total (without caudal); the distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. The diameter of the eye is less than the length of the snout, which is pointed. Maxillary of moderate length and width, its length being contained thrice and three-fourths in that of the head. Length of the mandible much more than the least depth of the tail. There are eight longitudinal series of scales between the lateral line and the root of the ventral fin.

Lake Huron.

The characters are taken from one of the typical specimens in the Haslar Collection; it is not in a good state of preservation. I believe that this species is distinct from *C. clupeoides* and *C. lucidus*, having the maxillary much less developed.

* *Body elevated, its height being one-third of the total length (without caudal).*

40. Coregonus tullibee.

Salmo (Coregonus) tullibee, *Richards. Faun. Bor.-Amer.* iii. p. 201.

D. 15. A. 15. V. 13. L. lat. 77. L. transv. 10/12.

The height of the body is one-third of the total length (without caudal), the length of the head more than one-fifth (the caudal fin included). The distance of the occiput from the front margin of the upper jaw is less than one-half of its distance from the origin of the dorsal fin. The diameter of the eye is less than the length of the snout, which is pointed. Maxillary long, about two-sevenths of the length of the head; length of the mandible more than the least depth of the tail. There are eight longitudinal series of scales between the lateral line and the root of the ventral fin.

Arctic North America.

a. Stuffed, 15 inches long. Albany River. Presented by Sir J. Richardson.

41. Coregonus cyprinoides.

Peled, *Lepechin, Reise*, iii. p. 226, taf. 12.
Salmo cyprinoides, *Pall. Zoogr. Ross.-As.* iii. p. 412.
—— pelet, *Pall. l. c.*
Coregonus cyprinoides, *Cuv. & Val.* xxi. p. 527.

D. 14. A. 15. V. 13. L. lat. 90.

The height of the body is one-third of the total length; head short, its length being less than one-fifth of the total; pectoral small.

Rivers Lena, Jenisei, Petschora.

I have not seen the typical specimen of this species.

12. THYMALLUS*.

Thymallus, *Cuv. Règne Anim.*

Body covered with scales of moderate size. Cleft of the mouth small; maxillary short, broad, scarcely extending beyond the front. margin of the orbit. Small teeth in the jaw bones, on the head of the vomer and the palatines; none on the tongue. Dorsal fin long, many-rayed; caudal forked. Pseudobranchiæ well developed; air-bladder very large. Stomach horseshoe-shaped, pyloric appendages rather numerous.

Temperate parts of the northern hemisphere.

1. Thymallus vulgaris.

The Grayling. Der Asch, Aesche. L'Ombre. Temelo or Temola (*Upper Italy*).

Θύμαλλος, *Ælian*, lib. xiv. c. 22.

Thymallus seu Thymus, *Bellon. De Aquat.* p. 184; *Salvian.* fol. 81. taf. 16; *Rondel.* ii. p. 187; *Gesner*, pp. 978, 979; *Aldrov.* v. c. 14. p. 594; *Jonston*, iii. tit. 1. c. 3, t. 26. figs. 3–5, and t. 31. fig. 6; *Willughby*, p. 187, tab. N. 8.

Coregonus no. 3, *Artedi, Synon.* p. 20; *Genera*, p. 10; and *Species*, p. 41.

Salmo, *Gronov. Zoophyl.* no. 375.

Salmo thymallus, *L. Syst. Nat.* i. p. 512; *Bl. Fische Deutschl.* i. p. 158, taf. 24; *Bl. Schn.* p. 410; *Donov. Brit. Fish.* iv. pl. 88; *Pall. Zoogr. Ross.-As.* iii. p. 364 (part.); *Meidinger*, tab. 33; *Turton, Brit. Faun.* p. 104; *Gronov. Syst.* ed. *Gray*, p. 153.

Asch, *Mars. Danub.* iv. p. 75, pl. 25. fig. 2.

Trutta, *Klein, Pisc. Miss.* v. p. 21. n. 15, tab. 4. f. 5.

Coregonus thymallus, *Lacép.* v. p. 254; *Flem. Brit. An.* p. 181; *Jurine, Poiss. du Lac Leman*, pl. 6.

Grayling, *Penn. Brit. Zool.* iii. p. 272, pl. 61, and ed. 1812, iii. p. 414, pl. 72; *Low, Faun. Orcad.* p. 224; *Davy, Salmonia*, 1851, p. 170; *Couch, Brit. Fish.* iv. p. 280, pl. 228.

Duhamel, Pesches, ii. p. 218, pl. 3. fig. 2.

Thymallus vulgaris, *Nilss. Prodr. Ichth. Scand.* p. 13, and *Skand. Faun. Fisk.* p. 447; *Jen. Man.* p. 430; *Yarr. Brit. Fish.* 2nd ed. ii. p. 136, 3rd ed. i. p. 304; *Siebold, Süsswasserfische*, p. 267.

Thymallus vexillifer, *Agass. Mém. Soc. Sc. Nat. Neuchâtel*, i. t. B, t. D. figs. 5–8 (anatomy); and *Poiss. d'eau douce*, pls. 15, 16; *Sélys-Longch. Faun. Belge*, p. 222; *Cuv. & Val.* xxi. p. 438; *Heckel & Kner, Süsswasserf.* p. 242.

Thymallus gymnothorax, *Cuv. & Val.* xxi. p. 445, pl. 625; *Günther, Fische des Neckars*, p. 117; *Rapp, Fische des Bodensee's*, p. 25.

Thymallus thymallus, *Kröyer, Danm. Fisk.* iii. p. 35.

B. 7–8. D. 20–23. A. 13–16. P. 16. V. 10–11. L. lat. 75–85. L. transv. $\frac{8-9}{14-16}$. Cæc. pyl. 22. Vert. 39/22.

The length of the head is two-ninths or one-fifth of the total (without caudal); posterior dorsal rays somewhat produced in the adult fish. Trunk generally with a few scattered, small, round, black dots. Dorsal fin violet, with purplish spots.

Fresh waters of Central and Northern Europe.

* 1. Thymalus ontariensis, *C. & V.* xxi. p. 452.—Lake Ontario.
2. —— mertensii, *C. & V.* xxi. p. 453.—Kamtschatka.

a, b. Adult. River Tyne. Presented by T. A. Knight, Esq.
c–f. Adult and half-grown: skins. River Swale. From Mr. Parnell's Collection.
g. Half-grown: skin. River Ure. From Mr. Parnell's Collection.
h. Adult: skin. British. From Mr. Yarrell's Collection.
i, k. Several specimens, adult and half-grown. Lapland. From Mr. Wheelwright's Collection.
l–m. Fine specimens. Gestrickland, Sweden. From Mr. Wheelwright's Collection.
n. Half-grown: skin. From Gronow's Collection.
o–p. Adult. Lake of Constance. From the Stuttgart Museum.
q. Adult: stuffed. Biel. From Mr. Yarrell's Collection.
r. Half-gown. Danube, near Ulm. From the Stuttgart Museum.
s–u. Half-grown. River Amper, Bavaria. From Dr. Gemminger's Collection.
v–x. Young. River Isar, Bavaria. From Dr. Gemminger's Collection.

2. Thymallus gymnogaster.

Thymalus gymnogaster, *Cuv. & Val.* xxi. p. 446, pl. 626.

L. lat. 100. Cæc. pyl. 17.

Belly naked, otherwise very similar to *Th. vulgaris.* (*Val.*)

Newa.

3. Thymallus æliani.

Thymalus æliani, *Cuv. & Val.* xxi. p. 447.

D. 17. A. 12. P. 15 V. 9. L. lat. 84.

Appears to differ from *Th. vulgaris* by the shortness of the dorsal fin. (*Val.*)

Lago Maggiore.

4. Thymallus pallasii.

Salmo thymallus, var. e Kovyma et e Sob, *Pallas, Zoogr. Ross.-As.* iii. p. 366.

Thymalus pallasii, *Cuv. & Val.* xxi. p. 448.

D. 21. A. 12. P. 16. V. 11. L. lat. 99. L. transv. $\frac{9}{8+\text{minores}}$.

The length of the head is contained five times and a half in the total (without caudal); the maxillary extends to the vertical from the front margin of the eye. The anterior dorsal rays are subequal in length; but the six posterior are much produced, forming a broad lobe, in a specimen 15½ inches long. Dorsal fin with red lines, which are interrupted by the shorter rays, but continuous and running upwards on the membrane between the long rays.

The rivers from which Pallas received this species, are named Kovyma and Sob by him. One of the typical specimens is in the Berlin Museum.

5. Thymallus tricolor.

Cope, Proc. Acad. Nat. Sc. Philad. 1865, p. 80.

B. 8. D. 21. A. 13. V. 10. P. 16. L. lat. 95–98.
L. trans. 10/11. Cæc. pyl. 22.

The height of the body is contained four times and two-thirds in

the total length (without caudal), the length of the head not quite five times; snout as long as the diameter of the orbit, the lower jaw being slightly the longer. The maxillary does not quite extend to below the middle of the pupil. The origin of the dorsal fin corresponds to the middle of the distance between operculum and ventrals; the penultimate dorsal ray is the longest, equal to the length of the head, not quite attaining the base of the anal. The pectoral extends beyond the origin of the dorsal. Dorsal fin with numerous blue spots, and two or three rows of narrow purple spots above them; upper margin purplish. (*Cope.*)

Michigan.

6. Thymallus signifer.

Hewlook-powak (*Esquim.*). Poisson bleu (*Canad. Voyagers*).
Coregonus signifer, *Richards. Frankl. Journ.* p. 711, pl. 26 (not correct).
—— thymalloides, *Richards. l. c.* p. 714 (young).
Salmo (Thymallus) signifer, *Richards. Faun. Bor.-Amer.* iii. p. 190, pl. 88.
Salmo (Thymallus) thymalloides, *Richards. l. c.* p. 190.
Thymalus signifer, *Cuv. & Val.* xxi. p. 450.

B. 8–9. D. 22–23. A. 12–13. P. 15. V. 9. L. lat. 84.
L. transv. 10/15. Cæc. pyl. 18.

The length of the head is nearly one-sixth of the total (without caudal); the maxillary extends somewhat beyond the vertical from the front margin of the eye. In mature examples the dorsal rays gradually increase in length from the first to the penultimate, the posterior ones being very long. Dorsal fin blackish, with rows of round blue spots; trunk with small, subquadrangular, blue spots.

Lakes and rivers north of the Mackenzie River.

13. ARGENTINA.

Argentina, *Artedi, Genera*, p. 8; *Cuv. Règne Anim.*
Argentina *et* Silus, *Gill, Proc. Acad. Nat. Sc. Philad.* 1862, p. 15.

Scales rather large. Cleft of the mouth small; intermaxillaries and maxillaries very short, not extending to below the orbit. Eye large. Jaws without teeth; an arched series of minute teeth across the head of the vomer and on the fore part of the palatines; tongue armed with a series of small curved teeth on each side, except in one species. Dorsal fin short, in advance of the ventrals; caudal deeply forked. Pseudobranchiæ well developed. Pyloric appendages in moderate numbers. Ova small.

Marine fish which never enter fresh waters, found in the European seas at considerable depths.

a. Tongue with teeth.

1. Argentina silus.

Gullax, Vas-sil (*Bergen*); Blankesteen (*Söndmör*).
Salmo silus, *Ascan. Ic.* tab. 24.
Blankesteen, *Ström, Naturhist. Selsk. Skrift.* ii. 2. p. 12, tab. 1. fig. 1.
Coregonus silus, *Cuv. Règne Anim.*; *Nilss. Prodr.* p. 19.

Silus ascanii, *Reinh. Bemärkn. til den Skand. Ichthyol.* p. 11.
Argentina silus, *Nilss. Observat. Ichthyol. Lund.* 1835, pp. 1–7; *Cuv. & Val.* xxi. p. 421; *Nilss. Skand. Faun. Fisk.* p. 469.
Acantholepis silus, *Kröyer, Danm. Fisk.* iii. p. 98; *Gaimard, Voy. Scand. & Lap. Poiss.* pl. 17 (not good).

B. 6. D. 11. A. 14. P. 17. V. 12. L. lat. 66. L. transv. $\frac{24}{4}$.
Vert. 65.

The length of the head is contained four times, or four times and one-seventh, in the total (with the caudal), the height of the body five times and a half; the diameter of the eye is one-third of the length of the head, and a little more than that of the snout. Scales spiny, the points of the spines being directed backward.

North-west coast of Norway.

a. Sixteen inches long. Purchased of Mr. Brandt.

2. Argentina sphyræna.

Sphyræna parva, *Rondel.* i. p. 227; cop. by *Gesner*, pp. 883, 1061.
Argentina, *Willughby*, p. 229; *Ray*, p. 108; *Artedi, Synon.* p. 17, and *Gen.* p. 8.
Argentina sphyræna, *L. Syst. Nat.* i. p. 518; *Risso, Ichthyol. Nice*, p. 336, and *Eur. Mérid.* iii. p. 462; *Cuv. Mém. Mus.* i. p. 234, pl. 11. fig. 1; *Nilss. Skand. Faun. Fisk.* p. 476.
—— cuvieri, *Cuv. & Val.* xxi. p. 413.

B. 6. D. 10. A. 12. P. 14. V. 11. L. lat. 52. Cæc. pyl. 12.
Vert. 50 (*Nilss.*).

The length of the head is contained four times, or four times and one-third, in the total (with the caudal), the height of the body eight times; the diameter of the eye is a little less than one-third of the length of the head, and nearly equal to the extent of the snout. The ventral fins are inserted nearly in the middle of the total length (the caudal not included).

Mediterranean.

a. Seven inches long. Old Collection.
b. Five inches long: bad state. Sicily. From W. Swainson's Collection.

3. Argentina hebridica.

Strömsild (*Christiania*).
The Argentine, *Low, Faun. Orcad.* p. 225.
Argentina silus jun., *Nilss. Observ. Ichthyol. l. c.*
Osmerus hebridicus, *Yarrell, Brit. Fish.* 2nd edit. ii. p. 133; *Couch, Brit. Fish.* iv. p. 297, pl. 233.
Argentina yarrellii, *Cuv. & Val.* xxi. p. 418; *Yarrell, Brit. Fish.* 3rd edit. i. p. 300.
Argentina hebridica, *Nilss. Skand. Faun. Fisk.* p. 474.

D. 9–11. A. 13 (12). P. 13–14. V. 11. L. lat. 52–53.
Cæc. pyl. 14–20. Vert. 52.

The length of the head is contained four times and four-fifths in the total (with the caudal), in younger individuals four times only, the height of the body five times and a half; the diameter of the eye

is contained from three times and one-third to three times and two-thirds in the length of the head, and equal to the extent of the snout. Scales with minute spines, very inconspicuous in young individuals.

Coasts of Norway and Scotland.

β. Tongue without teeth.

4. Argentina lioglossa.

Argentina leioglossa, *Cuv. & Val.* xxi. p. 417, pl. 624; *Guichen. Explor. Algér. Poiss.* p. 97.

D. 12. A. 14. P. 19 (22, Guich.). V. 12.

The length of the head is two-sevenths of the total, the height of the body one-seventh. The ventral fins are somewhat nearer to the root of the caudal than to the extremity of the snout. (*Val.*)

14. MICROSTOMA.

Microstoma, *Cuv. Règne Anim.*

Body elongate, cylindrical, covered with large, thin, silvery scales. Cleft of the mouth very small; intermaxillaries very small; maxillaries very short and broad. Eye very large. A narrow series of very small teeth in the lower jaw and across the head of the vomer; no other teeth. Dorsal fin short, inserted behind the ventrals, but before the anal. An adipose fin is present in most young examples, but frequently absent in adult ones; it is small and narrow, with its extremity fringed or lacerated. Caudal fin forked, the scales extending over its central rays. Pseudobranchiæ well developed; air-bladder large. Pyloric appendages none; mucous membrane of the stomach with numerous large papillæ.

Marine fishes, not entering fresh waters, from the Mediterranean.

This genus is allied to *Argentina* by the structure of its mouth, large eye, large scales, large silvery air-bladder, brown-coloured peritoneum, &c. Its systematic position has been a matter of uncertainty, on account of the absence of an adipose fin; for, although Risso represented this fish with such a fin, Valenciennes declared this to be incorrect. Large specimens, indeed, appear to lose this fin; our larger specimen does not show a trace of it; but that it is sometimes present in old examples is shown by the figure given by Risso. In some of our small specimens it is very conspicuous, in others quite rudimentary, and in a few I am unable to detect it. Our large specimen is a male; and although the ovaries have not yet been examined by an Ichthyologist, it is probable that they do not essentially differ from those of *Argentina*.

1. Microstoma rotundatum.

Gasteropelecus microstoma, *Risso, Ichth. Nice*, p. 356.
Microstoma rotundata, *Risso, Eur. Mérid.* iii. p. 475, fig. 36.
—— argenteum, *Cuv. & Val.* xviii. p. 358, pl. 544.

B. 4. D. 9–11. A. 8. P. 8. V. 10. L. lat. 52.

The height of the body is one-tenth or one-eleventh of the total

length, the length of the head two-elevenths; the diameter of the eye is two-fifths of the length of the head. Ventral fins midway between the end of the tail and the axil of the pectoral. Silvery.

Mediterranean.

a–c, *d–g*. Adult (7 inches) and young. Messina.
h–k. Young. Mediterranean. Purchased of Mr. Frank.

2. Microstoma (?) grœnlandicum.

Microstomus grönlandicus, *Reinhardt, Vidensk. Selsk. Naturvid. og Math. Afhandl.* viii. 1841, p. lxxiv.

B. 3. D. 11. A. 10. V. 10.

This fish appears to be intermediate between *Argentina* and *Microstoma*, having the dorsal fin inserted for the greater part in advance of the ventrals, and a series of fine teeth in the lower jaw; teeth on the vomer, none on the tongue. Adipose fin conspicuous. The height of the body is one-half of the length of the head, and one-tenth of the total.

Sea of Greenland.

Second Group. SALANGINA.

15. SALANX.

Salanx, *Cuv. Règ. Animal.*
Leucosoma, *Gray, Zool. Misc.* p. 4.

Body elongate, compressed, naked or covered with small, exceedingly fine, deciduous scales (?)*. Head elongate and much depressed, terminating in a long, flat, pointed snout. Eye small. Cleft of the mouth wide; jaws and palatine bones with conical teeth, some of the intermaxillaries and mandibles being enlarged; no teeth on the vomer; tongue with a single series of curved teeth (see *S. microdon*). Dorsal fin placed far behind the ventrals, but in front of the anal; anal long; adipose fin small; caudal forked. Pseudobranchiæ well developed; air-bladder none. The entire alimentary canal straight, without bend; pyloric appendages none. Ova small.

Seas and rivers of China and Japan.

1. Salanx chinensis.

The "Whitebait" of Macao.
Albula chinensis, *Osbeck, Reise in China, Rostock*, 1765, p. 309, or Swed. edit. p. 237.
? Synodus macrocephalus, *Lacép.* v. p. 320, pl. 9. f. 1 (very bad).
Leucosoma reevesii, *Gray, Zool. Misc.* p. 4.
—— chinensis, *Richards. Ichthyol. Chin.* p. 303.

* There is no trace of scales in specimens preserved in spirits for some time; but others, which we received lately, show scattered fragments of scales, without any regular arrangement.

Salanx cuvieri, *Cuv. & Val.* xxii. p. 360.
—— reevesii, *Cuv. & Val.* xxii. p. 363, pl. 646.

B. 3. D. 11. A. 26–29. P. 10–12. V. 7.

The length of the head is one-fifth of the total; head nearly twice as broad as deep, its greatest width being contained thrice and one-third in its length. Three canine-like teeth on the symphysis of the lower jaw, received into three holes by which the upper jaw is perforated. Tongue with teeth. The root of the ventral fin is in the middle of the total length. The dorsal fin terminates before the anal. Colourless.

China.

a. Adult (7½ inches long). China. Presented by General Hardwicke.—Type of *Leucosoma reevesii*.
b–c. Adult. Amoy. Purchased of Mr. Stevens.
d–f. Adult. China. From the Haslar Collection.
g. Young. China.

2. Salanx microdon.

Salanx (Salangichthys) microdon, *Bleeker, Act. Soc. Sc. Indo-Nederl.* vii. *Japan*, vi. p. 100.

B. 4. D. 13. A. 26–27. P. 16. V. 7.

The length of the head is contained six times and a half in the total; head as high as broad posteriorly; the diameter of the eye is about one-fifth of the length of the head. Intermaxillary teeth subequal in size; posterior mandibulary teeth larger than the anterior; tongue without teeth (?). The posterior dorsal rays are opposed to the anterior ones of the anal fin.

Rivers of Jeddo.

a–b. Types of the species, in bad state. From Dr. Bleeker's Collection.

Fam. 8. PERCOPSIDÆ.

Percopsides, *Agass. Lake Superior*, p. 286.

Body covered with ctenoid scales. Margin of the upper jaw formed by the intermaxillary; opercular apparatus complete. Barbels none. Gill-opening wide; pseudobranchiæ? Adipose fin present. Ovaries? (probably as in Salmonidæ). Pyloric appendages?

Freshwater fishes of North America.

The characters of this family are but incompletely known; as far as our present knowledge reaches, it would appear that it has some affinity to the *Haplochitonidæ*, from which it differs in having ctenoid scales.

Only one genus is known.

1. PERCOPSIS.

Percopsis, *Agassiz, l. c.* p. 284.

This genus reminds us in its general habit of *Acerina*. Scales of moderate size; head naked. The dorsal fin occupies nearly the middle of the length of the fish; and the ventrals, which are eight-rayed, correspond to its anterior rays. Adipose fin small; caudal forked; anal short. Nostrils close together, before the eye, which is of moderate size and without adipose eyelid. Minute, villiform teeth in the jaws, none on the palate. Mouth small.

Lake Superior.

1. Percopsis guttatus.

Percopsis guttatus, *Agass. l. c.* p. 286, pl. 1. figs. 1–2.
Percopsis (Salmoperca) pellucida, *Thompson, Proc. Bost. Soc. Nat. Hist.* iii. 1851, pp. 164, 306.

B. 6. D. 12. A. 8. P. 12. V. 8.

The height of the body is contained four times and a half in the total length (without caudal), the length of the head thrice and two-thirds. The eye is somewhat nearer to the gill-opening than to the end of the snout. Pectorals shorter than the head, extending beyond the root of the ventral. Body with a silvery band along its middle, and with longitudinal series of round dark spots above the band.

Sault St. Mary, Michipicotin, Fort William.

Percopsis hammondii (Gill, Proc. Acad. Nat. Sc. Philad. 1864, p. 151) is said to be distinguished by a longer head, its length being two-sevenths of the total (without caudal).

From Kansas.

Fam. 9. GALAXIDÆ.

Galaxiæ, *Müller, Abhandl. Akad. Wiss. Berl.* 1844, p. 187.

Body naked; barbels none. Margin of the upper jaw chiefly formed by the intermaxillaries, which are short and continued by a thick lip, behind which are the maxillaries. Belly rounded. Adipose fin none; dorsal opposite to anal. Pyloric appendages in small number. Air-bladder large, simple; pseudobranchiæ none. The ova fall into the cavity of the abdomen before exclusion.

Fresh waters of the temperate zone of the southern hemisphere. One genus only.

1. GALAXIAS.

Galaxias, *Cuv. Règne Anim.*
Mesites, *Jenyns, Voy. Beagle, Fish.* p. 118.

A series of conical teeth in the jaws, on each palatine bone, and on each side of the tongue; teeth on the tongue hook-like.

Australia, New Zealand, southern parts of South America.

1. Galaxias alepidotus.

Esox alepidotus, *Forster, Descript. Anim.* cur. *Lichtenst.* p. 142; *Bl. Schn.* p. 395.
Galaxias alepidotus, *Cuv. Règne Anim.*; *Richards. in Dieffenb. New Zealand, App.* p. 219; & *Zool. Ereb. & Terr. Fish.* p. 77.
—— forsteri, *Cuv. & Val.* xviii. p. 351.

B. 10. D. 13. A. 11–15. V. 7. P. 11. Cæc. pyl. 2.

Body stout; head broad, depressed, its length being equal to the height of the body, and more than one-fourth of the total (without caudal). Lower jaw a little shorter than the upper; cleft of the mouth wide, the maxillary extending to behind the vertical from the middle of the eye. Eye of moderate size, one-fifth of the length of the head, and two-thirds of the extent of the snout. The length of the pectoral fin is more than one-half of the distance of its root from the ventral, and the ventral terminates at a short distance from the vent; the anal extends beyond the base of the caudal, if laid backwards. The least depth of the tail is more than the distance between dorsal and caudal fins. Blackish brown, with scattered, small, round, light-coloured spots or streaks. Fins blackish.

New Zealand.

a–c. Seven and eight inches long. Presented by Captain Stokes.

2. Galaxias truttaceus.

Cuv. Règne. An.; *Cuv. & Val.* xviii. p. 344, pl. 543; *Richards. Zool. Ereb. & Terr. Fish.* p. 75, pl. 42. figs. 1–6.

B. 9. D. 11. A. 14–15. V. 7. P. 14.

Body stout; head broad, depressed, its length being somewhat more than the height of the body, and two-ninths or a little less than two-ninths of the total (without caudal). Jaws equal in length. Cleft of the mouth of moderate width, the maxillary not quite extending to below the middle of the eye. Eye of moderate size, two-ninths of the length of the head, and shorter than the snout. The length of the pectoral fin is one-half of the distance of its root from the ventral, and the ventral terminates at a considerable distance from the vent; the anal, if laid backwards, extends scarcely to the base of the caudal. The least depth of the tail is somewhat more than one-half of the distance between caudal and dorsal fins. Dark olive-coloured, with numerous small, round, blackish spots; two or three dark cross bars above the pectoral; an oblique blackish streak below the eye; extremities of the dorsal, anal, and pectoral fins black.

Van Diemen's Land.

a, b, c–d, e–h. Adult and half-grown.
i. Adult: stuffed. Purchased of Mr. Knight.

3. Galaxias olidus.

D. 11. A. 13. P. 14. V. 7.

Body stout; head thick, its length being about equal to the height of the body, and two-ninths of the total (without caudal). The lower jaw a little shorter than the upper; cleft of the mouth of moderate width, the maxillary not quite extending to below the middle of the eye. Eye rather small, less than one-sixth of the length of the head, and much shorter than the snout. The length of the pectoral fin is less than one-half of the distance of its root from the ventral, and the ventral fin terminates at a considerable distance from the vent; anal fin, if laid backwards, scarcely extending to the base of the caudal. The least depth of the tail is one-half of the distance between caudal and dorsal fins. Brownish red above, yellowish red below; all the fins and the opercles with thick black dots; a few scattered similar dots on the side of the tail.

? Queensland.

a. Four inches long. From Mr. G. Krefft's Collection.

4. Galaxias fasciatus.

Hepara (*Maori*); Trout or Rock-Trout.

Galaxias fasciatus, *Gray, Zool. Misc.* p. 73, and *Dieffenb. New Zealand*, ii. p. 221; *Cuv. & Val.* xviii. p. 350; *Richards. Zool. Ereb. & Terr. Fish.* p. 77.

Galaxias brocchus, *Richards. l. c.* p. 76, pl. 43. figs. 8–13.
—— reticulatus, *Richards. l. c.* pl. 42. figs. 7–12.

D. 11–12. A. 14–15. P. 13. V. 7. Cæc. pyl. 2. Vert. 35/26.

Body stout; head broad, depressed, its length being a little more than the height of the body, and two-ninths of the total (without caudal). Lower jaw a little shorter than the upper; cleft of the mouth wide; the maxillary extending to behind the vertical from the middle of the eye. Eye of moderate size, one-fifth or rather less than one-fifth of the length of the head, and two-thirds of the extent of the snout. The length of the pectoral fin is more than one-half of the distance of its root from the ventral, and the ventral terminates at a short distance from the vent; the anal, if laid backwards, extends beyond the base of the caudal. The least depth of the tail equals the distance between dorsal and caudal fins. Blackish brown, with undulated, more or less irregular, light-coloured cross bars. Fins blackish. Generally a black and white spot behind the gill-opening.

New Zealand and neighbouring islands.

Var. a. Body with rather regular narrow cross bars. (*G. fasciatus.*)

a–c. Types of the species. New Zealand. From Dr. Dieffenbach's Collection.

d. Adult. New Zealand. Presented by Dr. A. Sinclair.

e. Adult male: skeleton. From Dr. Dieffenbach's Collection.

Var. β. The bands are confluent into about seven irregularly shaped rings.

f. Type of *G. brocchus.* Auckland Islands. Presented by Sir J. Richardson.

Var. γ. The bands are very irregular, forming a sort of network.

g, h, i. Types of *G. reticulatus**. Auckland Islands. Presented by Sir J. Richardson.

k–m. Adult. New Zealand. Presented by Capt. Stokes.

n. Adult: bad state. New Zealand. Presented by the Lords of the Admiralty.

o. Young. Presented by Sir A. Smith.

5. Galaxias attenuatus.

Mesites attenuatus, *Jenyns, Zool. Beagle, Fish.* p. 121, pl. 22. fig. 5.
Galaxias truttaceus, *Valenc. in Cuv. Règne Anim. ill. Poiss.* pl. 97. fig. 2 (not *Cuv.*).
—— attenuatus, *Cuv. & Val.* xviii. p. 348.
—— scriba, *Richardson, Zool. Ereb. & Terr. Fish.* p. 76 (not *Cuv. & Val.*)
—— maculatus, *Richards. l. c.* p. 75, pl. 43. figs. 14–17 (not correct), (not *Jenyns*).

D. 11. A. 17. P. 12. V. 7. Cæc. pyl. 2†.

Body elongate, its depth in front of the dorsal fin being one-eighth

* The minute asperities on the skin of a specimen of *G. reticulatus*, mentioned by Sir J. Richardson, are visible also on specimens of the other varieties.

† They are short, and were overlooked by Jenyns.

or one-tenth of the total length (without caudal); the length of the head is nearly one-sixth of the total (without caudal). Snout with the jaws equal in length; cleft of the mouth rather narrow; the maxillary extending to below the anterior margin of the orbit. Eye of moderate size, somewhat shorter than the snout, more than one-fifth of the length of the head. The length of the pectoral is much less than one-half of the distance of its root from the ventral, and that of the ventral is one-third or nearly one-third of the distance of its root from the anal. The least depth of the tail is one-half of the distance between dorsal and caudal fins. Caudal emarginate. Yellowish-olive, body with numerous faint spots, each spot being composed of minute dots. Operculum silvery.

New Zealand, Van Diemen's Land, Falkland Islands, and southern parts of South America.

I have been unable to detect any specific difference in the American and Australian specimens which I have had an opportunity of examining.

a. Six and three-quarters inches long. Derwent River, Tasmania. Presented by Sir J. Richardson. Type of *G. scriba*, Richards.

b. Many specimens. Hobart Town. Presented by J. B. Jukes, Esq.

c, *d–e*. Three and a half and four inches long. New Zealand. From Mr. G. Krefft's Collection.

f, *g*. Three, and four and a half, inches long. Falkland Islands. Types of *G. maculatus*, Richards.

h–l. Two and a half to four inches long. Peru? Presented by the Royal College of Surgeons.

m. Two and a half inches long. Peru? From Mr. Pentland's Collection.

6. Galaxias krefftii.

D. 12. A. 16. P. 12. V. 7.

Body moderately elongate, subcylindrical, its depth in front of the dorsal being contained seven times and one-half in the total length (without caudal); the length of the head is contained five times and one-half in the same. Snout broad, with the jaws equal in length; cleft of the mouth rather narrow; the maxillary extending nearly to below the front margin of the orbit. Eye of moderate size, as long as the snout, one-fourth of the length of the head. The length of the pectoral is considerably less than one-half of the distance of its root from the ventral; and that of the ventral is two-fifths of the distance of its root from the anal. The least depth of the tail is one-half of the distance between dorsal and caudal fins. Caudal truncate. Yellowish-olive (in spirits); back powdered with minute black dots.

New South Wales.

a–c. Three and three and a half inches long. Sydney. From Mr. G. Krefft's Collection.

d. Five inches long. Murray River.

This species is very closely allied to *G. attenuatus*, but has the head comparatively longer.

7. Galaxias scriba.

Cuv. & Val. xviii. p. 347.

D. 11. A. 15. P. 14. V. 7.

The height of the body is one-half of the length of the head, which is one-fifth of the total (with the caudal); the diameter of the eye is only two-fifths of the length of the head. Caudal fin truncated. Yellowish; minute black dots are crowded so as to form irregularly flexuous lines; a large blotch on the base of the caudal. (*Val.*)

Port Jackson.—Three inches long.

8. Galaxias maculatus.

Mesites maculatus, *Jenyns, Voy. Beagle, Fish.* p. 119, pl. 22. fig. 4.
? Galaxias maculatus, *Cuv. & Val.* xviii. p. 355.

B. 6. D. 10. A. 16. P. 12. V. 7.

Body elongate, its depth in front of the dorsal being one-eighth of the total length (without caudal); the length of the head is one-fifth of the total (without caudal). Snout with the jaws equal in length; cleft of the mouth rather narrow; the maxillary extending to below the anterior margin of the orbit. Eye rather large, equal in length to the snout, and about two-sevenths of the length of the head. The length of the pectoral is much less than one-half of the distance of its root from the ventral, and that of the ventral is one-half of the distance between dorsal and caudal. Caudal fin slightly emarginate. Body with more or less numerous, large, irregular, blackish-brown spots. (*Jen.*)

Tierra del Fuego; Patagonia. $2\frac{2}{3}$ inches long.

9. Galaxias alpinus.

Mesites alpinus, *Jenyns, Zool. Beagle, Fish.* p. 121.

D. 10. A. 16. P. 13. V. 7.

Very little difference in form between this species and *G. maculatus*. The eyes, however, are decidedly larger, being one-third of the length of the head. The head itself also appears somewhat longer, being nearly one-fifth of the entire length (with the caudal). Greenish-brown; back, sides, and fins immaculate, but thickly powdered with minute dark specks scarcely visible except under a lens. (*Jen.*)

Alpine freshwater lakes in Hardy Peninsula, Tierra del Fuego.

10. Galaxias punctatus.

D. 12. A. 16. P. 12. V. 7.

Body elongate, its depth in front of the dorsal being one-eighth of the total length (without caudal); the length of the head is one-sixth of the total (without caudal). Snout with the jaws nearly equal in length; cleft of the mouth rather narrow, the maxillary

extending nearly to below the anterior margin of the orbit. Eye two-thirds of the extent of the snout, and less than one-fifth of the length of the head. The length of the pectoral fin is nearly one-third of the distance of its root from the ventral, and that of the ventral fin two-fifths of the distance of its root from the anal. The least depth of the tail is one-half of the space between dorsal and caudal. Caudal fin emarginate. Light brownish-olive; upper half of the head and body with numerous small black spots or dots.

a. Fine specimen, 6½ inches long. Eastern Creek. From Mr. G. Krefft's Collection.

11. Galaxias brevipinnis.

B. 7. D. 11. A. 14. P. 13. V. 7. Cæc. pyl. 2. Vert. 65.

Body rather elongate, its depth in front of the dorsal fin being one-seventh or one-eighth of the total length (without caudal); head broad, depressed, one-fifth of the total length (without caudal); snout obtuse; the lower jaw the shorter; cleft of the mouth wide, the maxillary extending a little behind the vertical from the middle of the eye. Dentition as in *G. alepidotus* or *fasciatus*. Eye rather small, one-sixth of the length of the head, and much shorter than the snout. The length of the pectoral is one-half or rather less than one-half of the distance of its root from the ventral; and the ventral terminates at a great distance from the vent; the rays of the anal, if laid backwards, do not extend on to the base of the caudal; the least depth of the tail is two-thirds of the distance between dorsal and caudal fins. Caudal truncated. Yellowish or brownish olive, covered all over with dark-brown, irregularly reticulated bands; base of the fins with dark-brown spots. A black spot behind the gill-opening.

New Zealand.

a–c. Five to six inches long. New Zealand. Presented by Capt. Stokes.

d. Adult male: skeleton. New Zealand. Presented by Dr. A. Günther.

12. Galaxias gracillimus.

Mesites gracillimus, *Canestrini, Arch. Zool. Anat. e Fisiol.* iii. 1864, p. 100, tav. 4. f. 2.

D. 10. A. 16.

The length of the head is less than one-eighth of the total (with the caudal), the height of the body nearly one-fifteenth; the diameter of the eye is two-sevenths of the length of the head. Ventrals inserted in the middle of the total length (without caudal); caudal truncate. (*Canestr.*)

Chile. Described from a specimen 59 millims. long.

Fam. 10. MORMYRIDÆ.

Mormyri, *Müll. Abhandl. Akad. Wiss. Berl.* 1844, p. 189.

Body and tail scaly, head scaleless; barbels none. The margin of the upper jaw is formed in the middle by the intermaxillaries which coalesce into a single bone, and laterally by the maxillaries. Interoperculum sometimes rudimentary. On each side of the single parietal bone a cavity leading into the interior of the skull, and covered with a thin bony lamella. All the fins well developed; no adipose fin. A series of pores along the base of the dorsal and anal fins. Pseudobranchiæ none; gill-opening reduced to a short slit. Air-bladder simple. Two cæca pylorica behind the stomach.

Rivers of tropical Africa.

On the anatomy of the fishes of this family, and especially on the gelatinous band-like bodies situated on each side of the tail, which have been erroneously believed to be electric organs, see Rüppell, 'Fortsetzung der Beschreibung neuer Fische im Nil entdeckt,' p. 9; Gemminger, 'Electrisches Organ von *Mormyrus*;' Erdl, Abhandl. Bayr. Akad. Wiss. p. 209; Kölliker, Bericht von der zootom. Anstalt zu Würzburg, 1849; Valenciennes in the 'Histoire Naturelle des Poissons,' *ll. cc.*; Hyrtl, Denkschr. Akad. Wiss. Wien, 1856, xii. p. 1; Marcusen, Mém. Acad. Sc. St. Pétersb. 1864, t. vii.

The species of this family may be referred to the following genera:—

A narrow band of pointed teeth along the middle of the palate and of the tongue. 1. MORMYRUS, p. 214.

A broad patch of obtuse, molar-like teeth on the roof and bottom of the mouth. 2. HYPEROPISUS, p. 222.

No teeth on the palate or on the tongue ..... 3. MORMYROPS, p. 223.

1. MORMYRUS*.

Mormyrus, sp., *L. Syst. Nat.* i. p. 522; *Geoffr. Descr. Ég. Zool.* i. p. 265.
Mormyrus and Mormyrops, sp., *Müll. Berl. Abhandl.* 1844, p. 190.
Mormyrodes, Gnathonemus, Petrocephalus, *Gill. Proc. Acad. Nat. Sc. Philad.* 1862, p. 443.

A narrow band of pointed teeth along the middle of the palate and of the tongue.

* 1. *Mormyrus jubilini*, C. & V. xix. p. 252.—D. 85. A. 19.—Senegal.
2. —— *nacra*, C. & V. xix. p. 257.—Nile.

The species may be referred to the following divisions:—

I. Dorsal fin occupying the greater portion of the length of the back; anal short, p. 215.

II. Dorsal and anal fins subequal and moderate in length; snout long and decurved, p. 217.

III. Dorsal and anal fins subequal and moderate in length; cleft of the mouth terminal or directed upwards; snout short, p. 218.

IV. Snout short, obtuse, with the cleft of the mouth at its lower side, p. 220.

I. *Dorsal fin occupying the greater portion of the length of the back; anal short.*

1. Mormyrus caschive.

Mormyrus caschive, *Hasselq. It. Palæst.* p. 398; *Cuv. & Val.* xix. p. 227; *Marcusen, Mormyr.* p. 120*.

—— longipinnis, *Rüpp. Fortsetz. Beschreib. neuer Fisch. Nil*, p. 7, pl. 1. fig. 2.

D. 81–87. A. 18–20. V. 6. Vert. $\frac{21-22}{31-32}$.

Scales very small. Snout conical, much produced, slightly bent downwards, the pupil of the eye being exactly in the middle of the length of the head. Lower lip somewhat projecting beyond the upper. Teeth very small, slightly dilated, the crown with a shallow notch. The height of the body is nearly equal to the length of the head, which is two-ninths of the total (without caudal).

Nile.

a–b. Fine specimens, 23 inches long. Chartoum. From Consul Petherick's Collection.

c–f. Young. Lower Nile. From Dr. Rüppell's Collection.

Mormyrus rume, Cuv. & Val. xix. p. 247, pl. 569, is scarcely distinct from *M. caschive*; it is said to have the scales somewhat larger, about 112 along the lateral lime.—Senegal.

2. Mormyrus mucupe.

Mormyrus mucupe, *Peters, Monatsber. Acad. Wiss. Berl.* 1852, p. 275.

D. 71. A. 18.

Snout slender, decurved, with the lower jaw prominent. (*Peters.*)

Mossambique.

3. Mormyrus oxyrhynchus.

Mormyrus kannume, *Forsk, Descript. Anim.* p. 74 *Lacép.* v. p. 619; *Marcusen, Mormyr.* p. 114.

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* To show the variability of the fin-rays within the limits of a species, Dr. Marcusen has selected the instance of *Chromis niloticus* and *Tilapia*. But it is now perfectly well known that Africa is inhabited by a considerable number of Chromides; and nobody who has studied these fish, will doubt that *Tilapia* is a very distinct species from *Chr. niloticus*.

Mormyrus oxyrhynchus, *Geoffr. Descr. Ég. Poiss.* i. p. 270, pl. 6. fig. 1; *Joannis, Guér. Mag. Zool.* pl. 13 (bad); *Cuv. & Val.* xix. p. 242.
—— bachiqua, *Cuv. & Val.* xix. p. 248.

D. 58–66. A. 18–20. V. 6. L. lat. ca 130. Vert. $\frac{23-23}{26}$.

Snout conical, much produced, slightly bent downwards, the pupil of the eye being scarcely nearer to the end of opercle than to the extremity of the snout. Lower lip somewhat projecting beyond the upper. Teeth not very small, slightly dilated, the crown with a shallow notch. The height of the body is nearly equal to the length of the head, which is two-ninths or a little more than two-ninths of the total (without caudal).

Nile.

a, *b–d*, *e*, *f*. Adult and half-grown. Lower Nile.
g. Adult: stuffed. Egypt. Purchased of Dr. Heckel.
h–n. Half-grown and young. Chartoum. From Consul Petherick's Collection.
o. Adult male: skeleton. Lower Nile. From Consul Petherick's Collection.
p. Adult: skeleton. Lower Nile. From Dr. Rüppell's Collection.

4. Mormyrus longirostris.

Mormyrus longirostris, *Peters, Monatsber. Akad. Wiss. Berl.* 1852, p. 275.

D. 74. A. 18.

Head very long, with the snout slender and decurved; upper jaw prominent. (*Pet.*)

Mossambique.

5. Mormyrus geoffroyi.

? *Pococke, Reise*, i. p. 315, taf. 70; Engl. edit. p. 202 (according to Schneider).
? Centriscus niloticus, *Bl. Schn.* p. 113, tab. 30. fig. 1.
? Mormyrus geoffroyi, *Cuv. & Val.* xix. p. 240.

D. 74–77. A. 17–19. V. 6.

Scales very small. Snout conical, much produced, with its longitudinal axis nearly in the same line as the axis of the body; eye almost in the middle of the length of the head. Lower lip somewhat projecting beyond the upper. Teeth very small, slightly dilated, the crown with a shallow notch. The height of the body is nearly equal to the length of the head, which is two-ninths of the total (without caudal).

Nile.

a, *b*. Half-grown. Lower Nile.

It may appear doubtful whether these specimens are correctly referred to *M. geoffroyi*, as Valenciennes states eighty-four dorsal rays; however, as they agree in all other respects with Valenciennes's description of that species, I would not separate them under a distinct name.

6. Mormyrus hasselquistii.

Mormyrus herse, *Lacép.* v. pp. 621–623 (not *Sonn.*).
—— caschive, *Geoffr. Descr. Ég. Poiss.* i. p. 273, pl. 6. fig. 2.
—— hasselquistii, *Cuv. & Val.* xix. p. 253; *Marcusen, Mormyr.* p. 130.

D. 70. A. 18. L. lat. 115. Vert. 21/29.

Snout rather thick and obtuse, with the upper jaw somewhat projecting beyond the lower. Eye situated in the anterior third of the length of the head, which is one-fourth of the total (without caudal). Teeth very small, with their crown slightly emarginate.

Nile; West Africa.

a. Half-grown. West Africa. Purchased of Mr. Dalton.

7. Mormyrus macrophthalmus.

D. 64. A. 21. L. lat. 88.

Snout much shorter than in *M. caschive* and in the other species allied to it; it is compressed, and abruptly bent downwards, the upper profile of the head being strongly curved; it is not much longer than the eye, which is large, two-sevenths of the length of the head. Jaws equal anteriorly, armed with small teeth, which are dilated and truncated at their summits. The length of the dorsal is not quite one-half of the total; anal much higher than dorsal, its distance from the caudal being one-fourth of the total length. Caudal forked to the base, with the lobes slender and pointed. The pectoral extends to, or nearly to, the root of the ventral, the length of which is two-thirds of that of the pectoral. The height of the body is one-fifth of the total length (without caudal), the length of the head one-sixth. Coloration uniform, sides shining silvery.

West Africa.

a. Male, 13 inches long. Purchased of Mr. Dalton.

II. *Dorsal and anal fins subequal and moderate in length; snout long, decurved.*

8. Mormyrus tamandua.

Mormyrus tamandua, *Günth. Proc. Zool. Soc.* 1864, January, pl. 2. fig. 1.

D. 28. A. 31. L. lat. 80.

Snout much prolonged, tubiform, tapering and curved downwards; the lower jaw terminating in a short skinny flap as long as the eye. The distance between the eye and the gill-opening is half that between eye and the end of the mandibulary flap; eye rather small. Teeth very small, conical, few in number. Pectoral nearly twice as long as the ventral, extending beyond its base. The height of the body is two-ninths of the total length (without caudal), the length of th head one-fourth.

West Africa.

a. Type of the species. Purchased of Mr. Dalton.

9. Mormyrus petersii.

Mormyrus petersii, *Günth. Wiegm. Arch.* 1862, p. 64, and *Proc. Zool. Soc.* 1864, p. 22, pl. 2. fig. 2.

D. 27. A. 34. L. lat. 66.

Snout subconical, somewhat decurved, with the mandible prolonged into a long, conical, fleshy appendage, which is nearly half as long as the head. Eye small, situated before the middle of the length of the head. Teeth very small, dilated, notched at the apex, few in number. Pectoral extending beyond the middle of the length of the ventrals. The height of the body is rather more than one-fourth of the total length (without caudal), the length of the head two-ninths. Dark brown, with two lighter cross bands between dorsal and anal fins.

Old Calabar.

a. Type of the species. Presented by Dr. A. Günther.

III. *Dorsal and anal fins subequal and moderate in length; snout obtuse; cleft of the mouth terminal or directed upwards; snout short* *.

10. Mormyrus cyprinoides.

Mormyrus cyprinoides, *L. Mus. Ad. Frid.* p. 109, and *Syst. Nat.* i. p. 522; *Rüpp. Forts. Beschreib. Nil-Fische*, taf. 2. fig. 4; *Cuv. & Val.* xix. p. 265.

—— labiatus, *Geoff. Descr. Ég. Poiss.* i. p. 275, pl. 7. fig. 1.

—— salahié, *Lacép.* v. p. 621.

—— elongatus, *Rüpp. l. c.* p. 2, taf. 2. fig. 1; *Cuv. & Val.* xix. p. 269.

—— abbreviatus, *Cuv. & Val.* xix. p. 270.

Mormyrops labiatus, *Marcusen, Mormyr.* p. 137.

—— elongatus, *Marcusen, Mormyr.* p. 140.

—— abbreviatus, *Marcusen, Mormyr.* p. 142.

D. 26–28. A. 32–35. V. 6. L. lat. 85. Vert. 16–17/29–30.

Snout obtuse, of moderate length, with the lower jaw prominent, and with a very short, skinny flap at the chin. Eye rather small, situated before the middle of the length of the head. Teeth minute, pointed, few in number. Pectoral extending beyond the root of the ventrals. The height of the body is one-fourth or two-sevenths of the total length (without caudal), the length of the head one-fifth or somewhat less than one-fifth.

Nile; West Africa.

a, b, c–d, e–f. Adult, half-grown, and young. Lower Nile.

g. Adult male. Egypt. From Dr. Rüppell's Collection.—One of the typical specimens of *M. elongatus*.

h. Half-grown. Chartoum. From Consul Petherick's Collection.

i, k. Adult and half-grown. West Africa. Purchased of Mr. Dalton.

The proportions of the body, especially its depth, depend in a great measure on the sex of the individual, and on the season, as in

* To this section appears to belong a species from Dongola, which, at present, I know from a bad figure only—*Mormyrus pictus*, Heuglin in Sitzgsber. Akad. d. Wissenschaften, 1852, ix. taf. 60. fig. 1; *Petrocephalus pictus*, Marcusen, l. c. p. 153.

other fishes. The *Mormyri*, besides, accumulate at certain periods such a quantity of fat in the abdominal cavity as well as between the muscles, that their appearance is very much changed—a circumstance by which Rüppell has been induced to establish a nominal species for specimens which either are males, or had lost the fat.

11. Mormyrus macrolepidotus.

Mormyrus macrolepidotus, *Peters, Monatsber. Akad. Wiss. Berl.* 1852, p. 275.

D. 23–24. A. 28–32. L. lat. 67.

The form of the snout, the eye, and the dentition as in *M. cyprinoides*; the pectoral extends to the middle of the ventral. The height of the body is two-sevenths of the total length (without caudal), the length of the head two-ninths.

Eastern Africa.

a. Young. River Rovuma. Presented by Ch. Livingstone, Esq.
b. Young. River Rovuma. Presented by Dr. Kirk.

12. Mormyrus niger.

D. 18–20. A. 26–28. L. lat. 52.

Snout obtusely conical, with the mouth terminal, and the upper profile somewhat more curved than the lower; lower jaw without fleshy protuberance, not projecting beyond the upper. Eye small, much shorter than the snout, situated before the middle of the length of the head. Teeth small, deeply notched, few in number. Pectoral longer than the head, extending nearly to the end of the ventral, which is only half as long. The height of the body is two-sevenths of the total length (without caudal), the length of the head one-fifth. Blackish, with indistinct and irregular darkish cross bands; head, back, and fins black.

Gambia.

a. Male, 5 inches long. Purchased of Mr. Dalton.
b–c, d. Five inches long. West Africa.

13. Mormyrus brachyistius.

Marcusenius brachyistius, *Gill, Proc. Acad. Nat. Sc. Philad.* 1862, p. 139.

D. 17. A. 27. L. lat. 50.

Head decurved; snout convex; teeth emarginate, few in number. Pectorals shorter than the head, and scarcely extending to the root of the ventrals. The height of the body is nearly equal to the length of the head, and one-fifth of the total (without caudal). (*Gill.*)

West Africa.

IV. *Snout short, obtuse, with the cleft of the mouth at its lower side.*

14. Mormyrus bane.

Rifaud, Voy. Ég. pl. 189. no. 40 (bad), pl. 217. fig. 2. (bad).
Mormyrus cyprinoides, *Geoff. Descr. Ég. Poiss.* i. p. 277, pl. 8. figs. 3–4 (not *L.*).
—— bane, *Lacép.* v. p. 621; *Cuv. & Val.* xix. p. 276.
—— dequesne, *Cuv. & Val.* xix. p. 281.
? Mormyrus joannisii, *Cuv. & Val.* xix. p. 282.
Mormyrus ehrenbergii, *Cuv. & Val.* xix. p. 283.
Petrocephalus bane, *Marcusen, Mormyr.* p. 146.
? Petrocephalus de joannis, *Marcusen, Mormyr.* p. 149.

D. 30–32. A. 33–36. V. 6. L. lat. 42–45. Vert. 14/29.

Snout obtuse, compressed, very short, elevated, obliquely truncated in front, with the cleft of the mouth at its lower side, below the eye, which is of moderate size. Teeth very small, dilated, and notched, forming a complete series round the entire edge of both jaws. Pectoral extending beyond the root of the ventral, which is short, half as long as the pectoral. The height of the body is contained from twice and one-half to three times and one-quarter in the total length (without caudal), the length of the head four times, or four times and a third.

Nile.

a, *b*, *c–e*, *f–h*. Adult, half-grown, and young. Lower Nile.
i–l, *m–p*. Adult and half-grown. Chartoum. From Consul Petherick's Collection.
q. Adult, female: skeleton. Lower Nile. From Consul Petherick's Collection.
r. Adult, skeleton. Lower Nile. From Dr. Rüppell's Collection.

15. Mormyrus discorhynchus.

? Mormyrus discorhynchus, *Peters, Monatsber. Akad. Wiss. Berl.* 1852, p. 275.

D. 30–36. A. 24–27. L. lat. 70. Vert. 16/25.

Snout obtuse, rounded, compressed, as long as the eye, which is of moderate size; cleft of the mouth at the lower side of the snout, before the vertical from the front margin of the orbit. Teeth very small, dilated and notched, few in number. The pectoral extends somewhat beyond the middle of the ventral, which is more than half as long as the pectoral. The height of the body is one-third of the total length (without caudal), the length of the head one-fifth. Back and upper parts of the side irregularly marbled with brown.

Nile (? Mossambique).

a–c. Adult and half-grown. Chartoum. From Consul Petherick's Collection.
d. Adult male: skeleton. Chartoum. From Consul Petherick's Collection.

The short diagnosis given by Peters agrees with our specimens

from the Nile; still it is possible that the Mossambique fish may prove to be different when their characters are better known.

The ribs of this species show the peculiarity of being perforated by many holes along the middle of their upper half.

16. Mormyrus bovei.

Mormyrus bovei, *Cuv. & Val.* xix. p. 283.

D. 20–23. A. 31–33.

Form of the snout as in *M. bane*, the cleft of the mouth being below the middle of the orbit. The height of the body is nearly one-fourth of the total length (the caudal fin included). (*Val.*)

Nile.

17. Mormyrus isidori.

Mormyrus isidori, *Cuv. & Val.* xix. p. 285.

Petrocephalus isidori, *Marcusen, Mormyr.* p. 150, pl. 5. fig. 20 (not good).

D. 19–20. A. 24. L. lat. 55. Vert. 39.

Snout obtuse, rounded, compressed, short, but longer than the eye, which is rather small; cleft of the mouth at the lower side of the snout, below the front margin of the orbit. Teeth small, dilated, and notched, forming an arched series round the margin of both jaws. Pectoral extending to, or somewhat beyond, the middle of the ventral, which is not quite half as long as the pectoral. The height of the body is contained from twice and three-fourths to three times and one-third in the total length (without caudal), the length of the head four times and one-half.

Nile.

a–b. From 3 to 4 inches long. From Dr. E. Rüppell's Collection.

18. Mormyrus adspersus.

D. 19–21. A. 27. V. 6. L. lat. 50.

Snout compressed, short, elevated, subtruncated in front, the cleft of the mouth being at its lower side but before the vertical from the front margin of the eye. Eye small, as long as the snout. Teeth small, dilated, and notched, forming a complete series round the margin of both jaws. The origin of the dorsal fin is a little nearer to the root of the caudal than to the occiput. The pectoral extends beyond the extremity of the ventral, which is very small, only half as long as the head. The height of the body is contained thrice in the total length (without caudal), the length of the head four times and one-third. Light brownish, dotted all over with brown, the dots being largest and most numerous on the head, thorax, and on the vertical fins.

West Africa.

a. Three inches long. Purchased of Mr. Damon.

b. Three inches long. Purchased of Mr. Stevens.

19. Mormyrus catostoma.

D. 21. A. 26. L. lat. 41.

The form of the snout is nearly the same as in *M. isidori*, the cleft of the mouth being at the lower side of the snout, behind the front margin of the orbit. Teeth small, dilated and notched, forming a complete series round the margin of both jaws. The origin of the dorsal fin is a little nearer to the root of the caudal than to the occiput. The pectoral extends somewhat beyond the middle of the ventral, which is rather more than half as long as the pectoral. The height of the body is contained thrice in the total length, the length of the head thrice and two-thirds. Uniform silvery, back blackish.

Rovuma River.

a–c. Two inches long. Presented by Ch. Livingstone, Esq.
d–e. Two inches long. Presented by Dr. Kirk.

2. HYPEROPISUS.

Hyperopisus, *Gill, Proc. Acad. Nat. Sc. Philad.* 1862, p. 443.

Dorsal fin much shorter than anal. A large broad patch of obtuse, molar-like teeth on the roof and bottom of the mouth.

1. Hyperopisus dorsalis.

Kashoué, *Sonnini, Voy. Ég.* pl. 21. fig. 3.
Mormyrus bebe, *Lacép.* v. pp. 619, 622.
—— dorsalis, *Geoff. Descr. Ég. Poiss.* i. p. 276, pl. 8. figs. 1–2; *Cur. & Val.* xix. p. 271.
Phagrus dorsalis, *Marcusen, Mormyr.* p. 142.

D. 13–16. A. 56–62. V. 6. L. lat. ca. 110. Vert. 22/37 (55, *Marcusen*).

Snout obtuse, rather short, rounded, with the jaws equal anteriorly, and without labial appendage. Eye small, situated far before the middle of the length of the head. Teeth not very small, fixed, dilated, notched. Pectoral extending beyond the root of the ventral, which is short but more than half as long as the pectoral. The height of the body is contained from three times and three-fourths to five times in the total length (without caudal), the length of the head five times and one-half. The distance of the origin of the dorsal fin from the root of the caudal is one-half of its distance from the gill-opening.

Nile.

a–b. Adult and young. Chartoum. From Consul Petherick's Collection.
c, d–f. Adult and half-grown. Lower Nile.
g. Adult male: skeleton. Chartoum. From Consul Petherick's Collection.

2. Hyperopisus occidentalis.

Very similar to *H. dorsalis*.

D. 12. A. 65. V. 6. L. lat. ca. 110.

Snout obtuse, rather short, rounded, with the jaws equal anteriorly, and without labial appendage. Eye small, situated far before the middle of the length of the head. Teeth as in *H. dorsalis*, but rather smaller. Pectoral fin extending beyond the root of the ventral, which is short and half as long as the pectoral. The height of the body is contained four times and one-half in the total length (without caudal), the length of the head five times and one-half. *The distance of the origin of the dorsal fin from the root of the caudal is considerably less than one-half of its distance from the gill-opening.*

West Africa.

a. Sixteen inches long. Purchased of Mr. Dalton.

3. MORMYROPS.

Mormyrus, sp., *L.*

Mormyrops, sp., *Müller, Berl. Abhandl.* 1844, p. 190.

Isichthys *et* Marcusenius, *Gill, Proc. Acad. Nat. Sc. Philad.* 1862, p. 443.

Head elongate, about twice as long as high. No teeth on the palate or on the tongue.

1. Mormyrops anguilloides.

Herse, *Sonnini, Voy. Ég.* pl. 22. fig. 1; *Rifaud, Voy. Ég.* pl. 189. no. 40 (bad).

Mormyrus anguilloides, *L. Mus. Ad. Frid.* p. 110, and *Syst. Nat.* i. p. 522 (not synon.); *Geoffr. Descr. Ég. Poiss.* i. p. 274, pl. 7. fig. 2; *Cuv. & Val.* xix. p. 258; *Marcusen, Mormyr.* p. 132.

—— dendera, *Lacép.* v. p. 621.

D. 26–28. A. 39–42. V. 6. L. lat. 95. Vert. $\frac{23}{36}$.

Head nearly twice as long as high; snout subtetrahedral, of moderate length, rounded in front, with the upper jaw a little longer than the lower. Eye very small, situated in the anterior third of the length of the head. Teeth not very small, fixed, forming a curved series in both jaws, slightly notched at the apex. Dorsal fin more than half as long as the anal. The height of the body is contained from five times and a half to six times and a half in the total length (without caudal), the length of the head four times.

Nile.

a. Half-grown. Egypt. From Dr. Rüppell's Collection.

b. Half-grown. Nile, below the Cataracts. From Mr. J. Petherick's Collection.

2. Mormyrops deliciosus.

Oxyrhynchus deliciosus, *Leach in Tuckey, Narrat. Exped. River Zaire*, p. 410.
Mormyrus tuckeyi, *Cuv. & Val.* xix. p. 263.

D. 25–26. A. 42–46. L. lat. 90.

Head twice as long as high; snout subtetrahedral, of moderate length, rounded in front, with the upper jaw somewhat longer than the lower. Eye very small, situated in the anterior third of the length of the head. Teeth not very small, fixed, forming a series round the entire edge of the upper and lower jaw; they are pointed, becoming more truncated at the apex with age, without being notched. Dorsal fin more than half as long as the anal. The height of the body is contained five times and a half in the total length (without caudal), the length of the head four times.

West Africa.

a. Adult: stuffed. Zaire expedition.—Type of the species.
b. Adult: skin in spirits. West Africa. Purchased of Mr. Dalton.
c. Young. West Africa. Purchased of Mr. Stevens.
d. Forty-five inches long: stuffed. West Africa. Purchased of Mr. Dalton.

3. Mormyrops zambanenje.

Mormyrus zambanenje, *Peters, Monatsber. Akad. Wiss. Berl.* 1852, p. 275.

D. 24–26. A. 42–47. Vert. 62.

Similar to *M. anguilloides*. Dorsal fin only half as long as the anal. Mandible and intermaxillary with from thirty-two to thirty-six teeth. (*Pet.*)

Mossambique.

4. Mormyrops henryi.

Isichthys henryi, *Gill in Proc. Acad. Nat. Sc. Philad.* 1862, p. 444.

D. 44. A. 42. L. lat. 135.

Head twice as long as high, snout scarcely projecting, convex; eye small. Teeth dilated, with the crown notched. The height of the body is about one-tenth of the total length (without caudal), the length of the head one-seventh. (*Gill.*)

Habitat ——?

The true affinities of this species appear to be with *M. anguilloides*; however, no mention has been made whether or not it has teeth on the roof of the mouth.

Fam. 11. GYMNARCHIDÆ.

Body and tail scaly, head scaleless; barbels none. The margin of the upper jaw is formed in the middle by the intermaxillaries, which, in mature individuals, coalesce into a single bone, and laterally by the maxillaries. Sub- and interoperculum present, small; on each side of the parietal bone a cavity leading into the interior of the skull, and covered with a thin bony lamella. Dorsal fin extending nearly over the entire length of the back; tail tapering, without fin; anal and ventral fins absent. Vent nearly in the middle of the length of the fish. A series of pores along the base of the dorsal fin. Pseudobranchiæ none; gill-opening reduced to a slit on each side. Two cæca pylorica behind the stomach.

Rivers of Tropical Africa.

One genus only.

1. GYMNARCHUS.

Gymnarchus, *Cuv. Règne Anim.*

Each jaw with a single series of incisors; no teeth on the palate. Air-bladder cellular, very extensible, perhaps with the functions of a lung.

1. Gymnarchus niloticus.

Jerfar, *Rifaud, Voy. Égypte*, pl. 138 B. fig. 1 (bad).
Gymnarchus niloticus, *Cuv. Règne Anim.*; *Erdl, Abhandl. Bayr. Akad. Wiss.* 1847, p. 209 (osteol.); *Heckel, Denkschr. Akad. Wiss. Wien*, 1854, vi. p. 11, taf. 1–2; *Hyrtl, Denkschr. Akad. Wiss. Wien*, 1856, xii. p. 1, c. tab. (anat. and osteol.).

D. 203–208.

The length of the head is contained four times and one-third in that of the dorsal fin, and once and two-thirds in its distance from the vent. Seven teeth on each side of the intermaxillary. Pectoral fin rather shorter than the snout.

Nile; rivers of West Africa.

a. Adult. Upper Nile. From Mr. J. Petherick's Collection.
b–c. From four to five feet long: stuffed. West Africa. Purchased of Mr. Dalton.
d. Fine half-grown specimen. West Africa. Purchased of Mr. Dalton.
e, f. Young, 11 inches long. West Africa.
g. Adult. Purchased of Mr. Frank.
h. Adult: stuffed. Purchased of M. Parzudaki.
i. Skull of specimen *b*.

Fam. 12. ESOCIDÆ.

Esoces, part., *Müller, Abhandl, Akad. Wiss. Berl.* 1842, p. 188.

Body covered with scales, barbels none. Margin of the upper jaw formed by the intermaxillaries mesially, and by the maxillaries laterally. Adipose fin none; the dorsal fin belongs to the caudal portion of the vertebral column. Stomach without blind sac; pyloric appendages none. Pseudobranchiæ glandular, hidden; air-bladder simple; gill-opening very wide.

Freshwater fishes from the temperate regions of the northern hemisphere.

Only one genus is known.

1. ESOX.

Esox, (*Artedi*) *Cuv. Règne Anim.*

Body elongate, covered with small, cycloid scales, many with a muciferous channel; lateral line distinct. Eye of moderate size. Snout elongate, broad, depressed, with the lower jaw the longer; cleft of the mouth very wide. Teeth of the mandible in a single series, unequal in size, some large; intermaxillary, vomer, palatine, and hyoid bones with bands of cardiform teeth; maxillary toothless. Dorsal fin opposite the anal. Caudal forked.

Fresh waters of the temperate parts of Europe, Asia, and North America.

1. Esox lucius.

Synonymy for European Specimens.

The Pike. Hecht. Brochet. Lucio or Luzzo. Gädda (*Sweden*).
Lucius, *Bellon. De Aquat.* p. 296; *Rondel.* ii. p. 188; *Salv.* pp. 94, 95; *Schonev.* p. 44; *Aldrov. De Pisc.* p. 630; *Jonston*, iii. t. 3. c. 5, t. 29. f. 1; *Gesner, De Pisc.* p. 500; *Willugh.* p. 236, tab. P. 5. f. 2; *Ray, Syn.* p. 112; *Klein, Miss. Pisc.* v. p. 74, tab. 20. f. 1.
Esox no. 1, *Artedi, Synon.* p. 26; *Gen.* p. 10; and *Spec.* 53; *Gronov. Zoophyl.* no. 361.
Esox lucius, *L. Syst. Nat.* i. p. 516; *Bloch, Fische Deutschl.* i. p. 229,

* 1. Esox vermiculatus, (*Lesueur*) *C. & V.* xviii. p. 333.—Wabash River, United States.
2. —— lineatus, (*Lesueur*) *C. & V.* xviii. p. 335.—Wabash River.
3. —— lugubrosus, (*Lesueur*) *C. & V.* xviii. p. 338.—Tennessee.
4. —— phaleratus, (*Say*) *Lesueur, Journ. Ac. Nat. Sc. Philad.* i. p. 416.—East Florida.
5. —— umbrosus, *Kirtland, Bost. Journ. Nat. Hist.*
6. —— ohioensis, *Kirtland, Bost. Journ. Nat. Hist.*

t. 32; *Bl. Schn.* p. 390; *Lacép.* v. p. 297; *Reisinger, Prodr. Ichth. Hung.* p. 47; *Donov. Brit. Fish.* v. pl. 109; *Flem. Brit. An.* p. 184; *Jurine, Mém. Soc. Phys. et Hist. Nat. Genève*, iii. 1825, p. 231, pl. 15; *Ekström, Fische Mörkö*, p. 78; *Fries & Ekstr. Scand. Fisk.* p. 49, t. 10; *Nilss. Prodr.* p. 36, and *Scand. Faun. Fisk.* p. 348; *Pall. Zoogr. Ross.-As.* iii. p. 336; *Parnell, Wern. Mem.* vii. p. 272; *Yarr. Brit. Fish.* 1st edit. i. p. 383, 2nd edit. i. p. 434, 3rd edit. i. p. 343; *Sélys-Longch. Faune Belge*, p. 223; *Cuv. & Val.* xviii. p. 279; *Kröyer, Danm. Fisk.* iii. p. 236; *Gronov. Syst.* ed. *Gray*, p. 146; *Günther, Fische des Neckars*, p. 107; *Rapp, Fische des Bodensee's*, p. 11; *Heckel & Kner, Süsswasserfische*, p. 287; *Siebold, Süsswasserfische*, p. 325.

? Trigle, *Forsk. Catal. Pisc. Milet, in Faun. Arab.* pp. xviii. & xix.

Pike, *Pennant, Brit. Zool.* iii. p. 280, pl. 63, and ed. 1812, iii. p. 424, pl. 74; *Couch, Brit. Fish.* iv. p. 150.

Synonymy for American specimens.

? Esox musquinongy, *Mitchill, Mirror*, 1824, p. 297; *Kirtland, Zool. Ohio*, p. 194.—Mitchill has counted seventeen anal rays; and therefore it is probable that his typical specimens belonged to this species, and not to *E. estor*.

Esox lucius, *Richards. Faun. Bor.-Amer.* iii. p. 124; *Cope, Proc. Acad. Nat. Sc. Philad.* 1865, p. 79.

Esox boreus, *Agass. Lake Super.* p. 317.

Osteology.

Spix, Cephalogenesis, pl. 1. f. 9, pl. 2. f. 9, pl. 5. f. 10; *Bojanus, Isis*, 1818, pl. 7. f. 6; *Rosenthal, Ichthyot. Taf.* pl. 5; *Agassiz, Rech. Poiss. Foss.* v. pls. F. & K.

B. 14. D. 21–23. A. 17–19. P. 15. V. 11. L. lat. 116–130. Vert. $\frac{41-43}{21-20}$.

Suboperculum and lower part of operculum scaleless. The length of the head is contained three times and one-third, or three times and one-fourth in the total (without caudal). The width of the band of vomerine teeth in its middle is more than one-half of that of the palatine band, and equal to that of the maxillary. Body with irregular roundish whitish spots, sometimes confluent into irregular cross bands on the tail; vertical fins with brown spots.

Europe, Northern Asia, and northern parts of North America.

a. Forty-five inches long: stuffed. England. Presented by Messrs. J. & C. Grove.

b. Half-grown. England. Presented by G. F. Gray, Esq.

c. Half-grown: stuffed. England.

d. Young. Thames. Presented by J. Doubleday, Esq.

e–k. Half-grown and young: stuffed. Loch Maben. From Mr. Parnell's Collection.

l. Young: skin. Holland. From Gronow's Collection.

m. Adult. Gotha River, Sweden. From Mr. Lloyd's Collection.

n–o. Young. Munio River, Lapland. From Mr. Wheelwright's Collection.

p. Adult. Lake of St. Stephanos, Turkey. Purchased of Mr. Millingen.

q. Young: stuffed. Mauritius (introduced). Presented by Mr. Telfair.
r. Large female: skeleton. Lough Earne, Ireland. Presented by the Earl of Enniskillen.
s. Adult: skeleton. England. Purchased of Mr. Warwick.
t. Half-grown: skeleton. Rhine. From Dr. A. Günther's Collection.
u. Adult: skeleton. Lake of St. Stephanos. Purchased of Mr. Millingen.

American specimens.

These specimens have generally seventeen anal rays, and but exceptionally nineteen; whilst the European examples have nineteen, a less number being found very rarely. There is also a faint brownish vertical suborbital band, traces of which may be observed sometimes in European examples.

a. Forty-two inches long: stuffed. Albany River. Presented by Sir J. Richardson.
b–c. Adult: stuffed. Arctic Expedition.
d. Adult: stuffed. Arctic North America. Presented by J. Rae, Esq.
e. Half-grown. Lake Whittlessey, Michigan. (Collected by J. H. Slack.)

Valenciennes describes under the name of *Esox australis* (Cuv. & Val. xviii. p. 323), a specimen in the Paris Collection said to have been brought by Péron from Van Diemen's Land. I need not mention that, if this is really the case, it must have been an example introduced from Europe, and that no true *Esox* is indigenous in the fresh waters of Australia.

2. Esox estor.

Muskellunge; Maskinonge.
Esox estor, *Lesueur, Journ. Acad. Nat. Sc. Philad.* i. 1818, p. 413; *Richards. Faun. Bor.-Amer.* iii. p. 126; *Dekay, New York Faun. Fish.* p. 222; *Cuv. & Val.* xviii. p. 324, pl. 542.

B. 18. D. 21. A. 20–21. P. 12. V. 11. L. lat. 162 (135).

Suboperculum and lower part of operculum scaleless. The band of vomerine teeth much narrower than in *E. lucius*. Body with large rounded whitish spots; vertical fins with dark spots.

Lakes Erie and Huron, and southern Canadian waters.

The principal differences between this species and the American *E. lucius* appear to be the greater number of anal rays, and the narrower band of vomerine teeth.

Two species are perhaps confounded under the name of *E. estor*; one, the true Muskellunge, is named *E. nobilior* by Thompson, Proc. Bost. Soc. Nat. Hist. iii. 1850, pp. 163, 173, and 305. This author says that the most obvious mark by which the two species may be distinguished is this: in *E. estor* the whole cheek in front of the

præoperculum is covered with scales, while in the *E. nobilior* the lower half of the cheek is entirely naked.

Mr. Cope, Proc. Acad. Nat. Sc. Philad. 1865, p. 79, refers *E. estor*, Lesueur, to *E. lucius*, but adopts *E. nobilior*, Thompson, which, he says, has not the frontal groove which is distinct in *E. lucius*. He has also counted nineteen branchiostegal rays in *E. nobilior*.

3. Esox depraudus.

Esox depraudus (*Lesueur*), *Cuv. & Val.* xviii. p. 330.

B. 15. D. 22. A. 21.

Opercles scaly. Brownish-green, with numerous oblong or rounded spots; fins with black spots.

Wabash River.

If this fish really has the opercles scaly, it cannot be identical with *E. estor* of Richardson, as Valenciennes supposes, the latter having the opercles scaleless, as is quite evident from Richardson's description.

4. Esox reticulatus.

? Esox lucius, *Schöpf, Naturforscher*, xx. 1784, p. 26.
? Esox americanus, *Lacép.* v. p. 299.
Esox lucius, var., *Mitch. Lit. & Phil. Trans. New York*, i. p. 440.
Esox reticulatus, *Lesueur, Journ. Acad. Nat. Sc. Philad.* i. 1818, p. 414; *Storer, Report Fish. Massach.* p. 97; *Kirtland, Zool. Ohio*, p. 194; *Dekay, New York Faun. Fish.* p. 223, pl. 34. fig. 107; *Cuv. & Val.* xviii. p. 327; *Cope, Proc. Acad. Nat. Sc. Philad.* 1865, p. 79.

B. 15. D. 17–19. A. 17. P. 15. V. 10. L. lat. 120–130.

Operculum and suboperculum entirely covered with scales. The length of the head is contained three times and one-fifth in the total (without caudal). The width of the band of vomerine teeth behind the middle of its length is one-half of that of the palatine band, and less than that of the maxillary. Sides with an imperfect network of brown streaks; a very distinct black suborbital band.

United States.

a. Half-grown. Boston. Presented by B. Winstone, Esq.
b, c–d. Half-grown. New York.

5. Esox niger.

Esox scomberius, *Mitchill.*
Esox niger, *Lesueur, Journ. Ac. Nat. Sc. Philad.* i. p. 415.
—— americanus, *Cuv. & Val.* xviii. p. 329 (not *Lacép.*).
—— fasciatus, *Dekay, New York Fauna, Fish.* p. 224, pl. 34. fig. 110; *Cope, Proc. Acad. Nat. Sc. Phil.* 1865, p. 79.
? Esox tredecim-radiatus, *Mitchill, Mirror*, 1825, p. 361; *Dekay, l. c.* p. 225.

D. 14–15. A. 14. V. 9.

Operculum and suboperculum entirely covered with scales. Eye nearer to the end of the upper jaw than to the margin of the operculum; a deep frontal groove. Vomerine teeth in a shorter series

than those of the palatine bones. A very distinct black suborbital band.

United States.

a. Young. New Orleans. Purchased of Mr. Cuming.

6. Esox ravenelii.

Holbrook, Fish. of South Carolina, p. .

Similar to *E. niger*, but with twelve dorsal rays only; and the vomerine series is longer than the palatine.

South Carolina.

7. Esox cypho.

Cope, Proc. Acad. Nat. Sc. Philad. 1865, p. 78.

B. 11–13. D. 16. A. 14. V. 9.

Operculum and suboperculum entirely covered with scales. Dorsal region elevated, with the outline arched: pectoral fins much nearer to the ventrals than to the end of the intermaxillary. The height of the body is one-fifth of the total length (without caudal), the length of the head two-sevenths. The eye is much nearer to the end of the snout than to the margin of the opercle. Frontal groove shallow. Brown, with numerous spots and vertical bars on the lower part of the sides; operculum obliquely barred; a black suborbital band. (*Cope.*)

Michigan.

Fam. 13. UMBRIDÆ.

Esoces, part., *Müller, Abhandl. Akad. Wiss. Berl.* 1842, p. 188.

Head and body covered with scales; barbels none. Margin of the upper jaw formed by the intermaxillaries mesially and by the maxillaries laterally. Adipose fin none; the dorsal fin belongs partly to the abdominal portion of the vertebral column. Stomach without blind sac; pyloric appendages none. Pseudobranchiæ glandular, hidden; air-bladder simple.

Freshwater fishes from Central Europe and temperate North America.

Only one genus is known, which, after being associated with various genera, proves to be represented in North America by a second species.

1. UMBRA.

Umbra, *Kramer, Elench. Anim. Austr. infer.* 1756.
Melanura, *Agassiz, Sillim. Amer. Journ.* 1853, xvi. p. 135.

Body oblong, covered with cycloid scales of moderate size, without radiated striæ; lateral line inconspicuous; eye rather small; cleft of the mouth of moderate width. Ventral fins inserted below, or somewhat in front of, the commencement of the dorsal, which is much longer than the short anal: caudal fin rounded. Villiform teeth in the jaws, and on the vomer and the palatine bones.

1. Umbra crameri.

Hundsfisch; Ribahal (*in Hungary*).
Gobius caninus, *Marsil. Danub.* iv. p. 43, tab. 13. fig. 2.
Cyprinodon umbra, *Cuv. Règne Anim.*
Umbra crameri, *Müller, Abhandl. Akad. Wiss. Berl.* 1842, p. 188; *Cuv. & Val.* xix. p. 542, pl. 590 (fig. med.); *Heckel & Kner, Süsswasserfische*, p. 292, c. fig. opt.

B. 5–6. D. 15–16. A. 7–8. V. 6. P. 13. L. lat. 33–35. L. transv. 5/7.

The height of the body is nearly equal to the length of the head, and two-sevenths or one-fourth of the total (without caudal). Brownish, with darker spots and dots.

Stagnant waters of Austria and Hungary; neighbourhood of Odessa.

From 3 to 4 inches long.

a–b. Adult and half-grown. Austria.

2. Umbra limi.

Hydrargyra limi, *Kirtland, Bost. Journ. Nat. Hist.* iii. p. 277, pl. 2. fig. 4.
Fundulus fuscus, *Ayres, ibid.* iv. p. 296, pl. 13. fig. 2.
Hydrargira atricauda, *Dekay, New York Faun. Fish.* p. 220.
—— fusca, *Thompson, Nat. Hist. Vermont*, p. 137.

D, 14–15. A. 9–10. V. 6. L. lat. 35. L. transv. 15.

The height of the body is less than the length of the head, which is two-sevenths of the total (without caudal). Brownish, irregularly marbled with dark brown, a brownish-black vertical band on the end of the tail.

Fresh waters of the United States.

a–f. From two to three inches long. United States. From Mr. Parnell's Collection.
g. Adult. Purchased of Mr. Brandt.

Fam. 14. SCOMBRESOCIDÆ.

Scomberesoces s. Pharyngognathi malacopterygii, *Müller, Abhandl. Akad. Wiss. Berl.* 1842, p. 170.

Body covered with scales; a series of keeled scales along each side of the belly. Margin of the upper jaw formed by the intermaxillaries mesially, and by the maxillaries laterally. Lower pharyngeals united into a single bone. Dorsal fin opposite the anal, belonging to the caudal portion of the vertebral column. Adipose fin none. Air-bladder generally present, simple, sometimes cellular, without pneumatic duct. Pseudobranchiæ hidden, glandular. Stomach not distinct from the intestine, which is quite straight, without appendages.

Marine fishes of the temperate and tropical zones, many species entering or inhabiting fresh waters.

At the commencement of my account of the *Physostomi* it was my intention to keep the *Scombresoces* as a distinct order, viz. *Malacopterygii pharyngognathi*; however, during the progress of a detailed examination of these fishes so many points of affinity with the *Cyprinodontes* became apparent, that I was reluctantly obliged to deviate still more from Müller's ordinal division. The coincidence of the two characters of united lower pharyngeals and of the absence of a pneumatic duct of the air-bladder deserves certainly full attention; but the backward position of the vertical fins, the modification of the anal fin of the male sex of many Cyprinodonts and of some Hemirhamphs, and the structure of the upper jaw of some Cyprinodonts, which is very similar to that of Hemirhamphus, are points which, at all events, prevent the Scombresoces from being widely separated from the other family named.

Therefore this family is to be excepted from the last of the characters of the Physostomes, as given vol. v. p. 1.

Synopsis of the genera.

Both jaws elongate into a long beak: finlets none....1. BELONE, p. 234.

Both jaws elongate into a long beak; finlets behind the dorsal and anal fins. 2. SCOMBRESOX, p. 256.

The lower jaw only elongate into a beak; intermaxillaries short, forming a triangular plate .....3. HEMIRHAMPHUS, p. 259.

Mouth as in *Hemirhamphus*, but the lower jaw not prolonged. Pectoral fin of moderate length.....4. ARRHAMPHUS, p. 276.

Jaws short; intermaxillaries and maxillaries not soldered together. Pectoral fins very long, organs of flying.....5. EXOCŒTUS, p. 277.

1. BELONE*.

Belone, *Cuv. Règne Anim.*

Both jaws prolonged into a long, slender beak, the upper part being formed by the intermaxillaries, which are united by a longitudinal suture. Both jaws with a band of asperities, and with a series of longer, conical, pointed, widely-set teeth. Body elongate, slender, covered with small scales. All the dorsal and anal rays connected by a membrane. Gill-openings very wide. Intestinal track simple, without pyloric appendages. Air-bladder large.

Seas of the temperate and tropical regions, many species entering fresh waters.

Very young specimens have the jaws not prolonged; and during growth the lower jaw is much more in advance of the upper than is the case when the fish has reached the adult state.

The numerous species may be subdivided thus:—

A. Anterior dorsal rays prolonged, forming a lobe, or giving a falciform appearance to the fin: *Belone*.

1. The free portion of the tail is strongly depressed, with a sharp lateral edge, p. 235.

2. The free portion of the tail is moderately or slightly depressed, without lateral edge; or the lateral line passes into a slight, generally black-coloured keel.

a. The posterior dorsal rays are more or less prolonged, the last extending nearly or quite to the root of the caudal fin, p. 238.

b. The middle and posterior dorsal rays are short, subequal in length, p. 242.

3. The free portion of the tail is strongly compressed; lateral line without keel.

a. No teeth on the palate, p. 248.

b. Teeth on the palate, p. 254.

B. Dorsal rays subequal in length, the anterior ones not forming a lobe: *Potamorrhaphis*, m.

* 1. Belone ardeola, *C. & V.* xviii. p. 425.—Martinique.
2. —— galeata, *C. & V.* xviii. p. 429.—Cayenne.
3. —— cigonella, *C. & V.* xviii. p. 436.—Portorico.
4. —— argalus, *C. & V.* xviii. p. 439.—Guadeloupe.
5. —— macrolepis, *Bleek. l. c.* xii. p. 225.—Nias.
6. —— esocina. *Basil. Nouv. Mém. Soc. Nat. Mosc.* 1855, x. p. 260.—China.
7. —— altipinna, *Poey, Mem. Cub.* ii. p. 293.—Cuba. D. 24. A. 23.
8. —— undecim-radiata, *Budge, in Müller, Archiv*, 1848, p. 383.—*Hab.*——?

A. *Anterior dorsal rays prolonged, forming a lobe, or giving a falciform appearance to the fin*: Belone.

1. *The free portion of the tail is strongly depressed, with a sharp lateral edge.*

1. Belone trachura.

Cuv. & Val. xviii. p. 456.

D. 15–17. A. 20–21.

The free portion of the tail is strongly depressed, with a sharp lateral edge; body subcylindrical. The length of the head is one-third of the total (with the caudal); its upper surface flat, striated, without distinct median groove; superciliary region striated; base of the intermaxillaries much depressed, maxillary entirely hidden by the præorbital. The lower jaw considerably longer than the upper. Teeth small; vomerine teeth none. The diameter of the eye is a little more than the width of the interorbital space, and one-half of the length of the postorbital portion of the head. Depth of the body considerably less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin nearly midway between head and caudal fin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a great distance from the root of the caudal. Caudal fin forked. Scales rather small, adherent.

Island of Ascension.

a–c. From 16 to 20 inches long. Old Collection.

2. Belone incisa.

Cuv. & Val. xviii. p. 451.

D. 19. A. 22.

The free portion of the tail depressed; body subcylindrical; the length of the head two-fifths of the total (with the caudal). Maxillary entirely hidden by the præorbital. Dorsal and anal fins not high, caudal truncate. Scales very small. (*Val.*)

Indian Ocean.

3. Belone depressa.

? Belone depressa, *Poey, Mem. Cuba*, ii. p. 296.

D. 13–14. A. 18–19.

The free portion of the tail is strongly depressed, and dilated into a broad, sharp edge on each side. Body rather depressed, subpentagonal. The length of the head is rather less than one-third of the total (without caudal); its upper surface flat, striated, without distinct median groove; superciliary region faintly striated; base of the intermaxillaries much depressed. Maxillary entirely hidden by the præorbital, which is scaly. Teeth very small; vomerine teeth none. The diameter of the eye is somewhat more than the width of the interorbital space, and one-half of the length of the postorbital portion of the head. Depth of the body considerably less than the

length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin nearly midway between eye and caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a great distance from the root of the caudal. The origin of the anal is in advance of that of the dorsal. Caudal fin forked. Scales not very small, adherent. Green above, silvery below.

West Indies (North-west Australia?).

a–b. Twelve inches long. Dominica. Purchased of Mr. Cutter.
c. Seventeen inches long. North-west Australia. From the Haslar Collection.
d. Three inches long. Jamaica.

4. Belone lovii.

D. 13. A. 18. P. 11.

The free portion of the tail is strongly depressed, and dilated into a broad sharp edge on each side. Body rather depressed, subpentagonal. The length of the head is rather more than one-third of the total (without caudal); its upper surface flat, striated, with a very shallow, scaly median groove; superciliary region slightly striated; base of the intermaxillaries much depressed. Maxillary entirely hidden by the præorbital, which is scaly; teeth very small; vomerine teeth none. The diameter of the eye is conspicuously more than the width of the interorbital space, and two-thirds of the length of the postorbital portion of the head. Depth of the body considerably less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin nearly midway between eye and caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a great distance from the root of the caudal. The origin of the anal is in advance of that of the dorsal. Caudal fin forked. Scales not very small, adherent. Greenish bronze-coloured above, silvery below.

Cape de Verde Islands.

a. Fifteen inches long. Presented by the Rev. R. T. Lowe.

5. Belone carinata.

Cuv. & Val. xviii. p. 437.

D. 15. A. 17.

The free portion of the tail is much depressed, with broad, sharp, lateral edges. Upper jaw much shorter than lower. Caudal fin emarginate. (*Val.*)

Sandwich Islands.

Perhaps identical with *B. platura*.

6. Belone platura.

? Belone platyura, *Benn. Proc. Comm. Zool. Soc.* 1830, p. 168.
Belone platura, *Rüpp. N. W. Fische*, p. 73, taf. 20. fig. 1; *Cuv. & Val.* xviii. p. 451; *Bleek, Act. Soc. Sc. Indo-Nederl.* ii., *Amboina*, viii. p. 85.

D. 13–14. A. 17.

The free portion of the tail is strongly depressed, with a sharp lateral edge. Body rather depressed, subpentagonal. The length of the head is contained twice and three-fourths in the total (without caudal); its upper surface flat, striated, with a broad, very shallow, scaly median groove; superciliary region striated; base of the intermaxillaries much depressed, maxillary entirely hidden by the præorbital. Teeth small; vomerine teeth none; tongue smooth. The diameter of the eye equals the width of the interorbital space, and is contained once and two-thirds in the length of the postorbital portion of the head. Depth of the body considerably less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin midway between eye and caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales rather small, adherent.

Rea Sea; ? Mauritius; East Indies.

a. Adult. Red Sea. Presented by Dr. E. Rüppell.
b. Half-grown. Amboyna. From Dr. Bleeker's Collection.

7. Belone microps.

D. 13–15. A. 14–15.

The free portion of the tail is strongly depressed, with a sharpish edge. Body depressed, rather broader than deep. The length of the head is one-third of the total (without caudal); its upper surface flat, smooth, with a narrow median groove; superciliary region quite smooth; base of the intermaxillaries depressed, maxillary half hidden by the præorbital. Teeth of moderate size, widely set; vomerine teeth none. The diameter of the eye is a little more than the width of the interorbital space, and one-fifth of the length of the postorbital portion of the head, which is rather more than half the length of the beak. Depth of the body considerably less than the length of the pectoral fin, which is less than the distance of the opercular margin from the orbit. Ventral fin a little nearer to the head than to the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal; origin of the anal somewhat in advance of that of the dorsal. Caudal forked, with the lobes subequal in length. Scales minute, adherent. The termination of the lateral keel on the caudal fin black.

Guianas.

a. Thirteen inches long. Surinam.
b. Thirteen inches long. British Guiana. Presented by Sir R. Schomburgk.
c. Eleven inches long. British Guiana. Purchased of Mr. Scrivener.

8. Belone angusticeps.

D. 16. A. 19.

Tail strongly depressed, with a sharpish lateral edge; body subcylindrical. The length of the head is somewhat more than one-third of the total (without caudal); it is narrow, elongate, rather convex above, with a deep median longitudinal groove. Base of the intermaxillaries depressed; teeth very small; maxillary half hidden by the præorbital. The diameter of the eye is one-fourth of the length of the postorbital part of the head, which is more than that of the pectoral fin. Ventral fin somewhat nearer to the head than to the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin somewhat emarginate. Scales very small. The termination of the caudal keel blackish.

Coast of Ecuador.

a. Eleven inches long. From Mr. Fraser's Collection.

The following species appears to belong to this division:—

9. Belone exilis.

Girard, Proc. Acad. Nat. Sc. Philad. 1854, p. 149, and *U. S. Pac. R. R. Exp. Fish.* p. 158.

D. 16. A. 20.

The length of the head is a little less than one-third of the total (without caudal); body subcylindrical, very slender. Upper surface of the head flat, with a longitudinal groove. Eye large, its diameter being one-third of the length of the postorbital part of the head. The anal fin commences somewhat in advance of the dorsal, the middle and hinder rays of these fins being short; ventral midway between the eye and the caudal; caudal fin moderately emarginate. Scales very small above the lateral line, larger below it. (*Gir.*)

San Diego, California.

2. *The free portion of the tail is moderately or slightly depressed, without lateral edge; or the lateral line passes into a slight, generally black-coloured keel.*

a. *The posterior dorsal rays are more or less prolonged, the last extending nearly or quite to the root of the caudal fin.*

10. Belone melanotus.

Belone melanotus, *Bleeker, Natuurk. Tydschr. Ned. Ind.* i. p. 94, or *Verh. Genootsch.* xxiv. *Snoek. Vissch.* p. 14.

Mastacembelus crocodilus, *Bleek. Ned. Tydschr. Dierk.* iii.* (not syn.).

D. 24–26. A. 22–24.

The free portion of the tail is subtetrahedral, scarcely higher than broad, with a slight, narrow longitudinal keel along the side. The length of the head is contained thrice and a sixth in the total (without caudal); its upper surface flat, striated, without conspicuous

* We have, at present, seen only a separate copy of this paper, and therefore are unable to refer to the pages.

median groove; superciliary region striated; base of the intermaxillaries broad, slightly compressed; maxillary entirely hidden by the præorbital. Teeth of moderate strength; vomerine teeth none. The diameter of the eye is a little less than the width of the interorbital space, and *one-half of the length of the postorbital portion of the head*. Body slightly compressed, its depth being less than the length of the pectoral fin, which nearly equals the distance of the opercular margin from the orbit. *Tongue covered with tubercular asperities*. Ventral fin midway between the front margin of the eye and the root of the caudal. The middle and hinder dorsal and anal rays are very slender and somewhat prolonged, the last extending nearly or quite to the root of the caudal. Caudal fin deeply forked. Scales very thin and minute, deciduous.

East Indian Archipelago.

a. Adult. Purchased of Mr. Frank.
b. Adult. From Dr. Bleeker's Collection (as *B. crocodilus*).

11. Belone schismatorhynchus.

Belone gracilis, *Schleg. Faun. Japon. Poiss.* p. 246, pl. 110. f. 1; *Bleek. Verh. Bat. Gen.* xxvi. *Nieuwe Nalez. Japan.* p. 116 (not *Lowe*).
Belone schismatorhynchus, *Bleeker, Nat. Tydschr. Ned. Ind.* i. p. 95, or *Verh. Genootsch.* xxiv. *Snoek. Vissch.* p. 15.
Mastacembelus gracilis, *Bleek. Ned. Tydschr. Dierk.* iii.

D. 24. A. 26.

The free portion of the tail is strongly compressed, much deeper than broad, with the lateral line slightly raised into an inconspicuous keel. The length of the head is contained about thrice and a fourth in the total (without caudal); its upper surface with a wide and shallow median groove, the anterior half of which is scaly; superciliary region striated; base of the intermaxillaries compressed, arched; maxillary nearly entirely hidden by the præorbital. Teeth feeble; vomerine teeth none. The diameter of the eye is equal to the width of the interorbital space, and contained twice and a fourth in the length of the postorbital portion of the head. Body strongly compressed, its depth being less than the length of the pectoral fin, which exceeds the distance of the opercular margin from the orbit. Ventral fin nearer to the front margin of the orbit than to the root of the caudal. The middle and hinder dorsal rays subequal in length, not very short, the last terminating at a short distance from the root of the caudal. Caudal fin forked. Scales minute.

Red Sea, Indian Ocean.

a. Adult, 18 inches long. Red Sea. Presented by Dr. E. Rüppell.

12. Belone choram.

Renard, ii. pl. 14. fig. 65.
Esox choram, *Forsk. Descr. Anim.* p. 67. no. 98. c.
Belona crocodila, *Lesueur, Journ. Ac. Nat. Sc. Philad.* ii. 1821, p. 129.
Belone choram, *Rüpp. N. Wirb. Fische*, p. 72.
—— crocodilus, *Cuv. & Val.* xviii. p. 440.

D. 22–23. A. 20–21.

The free portion of the tail is scarcely compressed, rather deeper

than broad, provided with a very slight lateral keel. The length of the head is one-third of the total (without caudal); its upper surface with a broad and very shallow median groove; superciliary region striated; base of the intermaxillaries depressed, maxillary nearly entirely hidden by the præorbital. Teeth strong; vomerine teeth none. The diameter of the eye is less than the width of the interorbital space, and *one-half of the length of the postorbital portion of the head*. Body subcylindrical, its depth being much less than the length of the pectoral fin, which equals the distance of the opercular margin from the orbit. *Tongue covered with tubercular asperities*. Ventral fin nearer to the head than to the root of the caudal. The middle and hinder dorsal rays are very slender and somewhat prolonged, the last extending nearly or quite to the root of the caudal. Caudal fin forked. Scales very thin and small, deciduous.

Eastern coasts of Africa.

a. Adult. Mozambique. From the Berlin Museum.
b. Half-grown: skin. Zanzibar. Presented by Lieutenant-Colonel Playfair.
c. Large specimen. Purchased of Mr. E. Gerrard, jun.

13. Belone annulata.

Russell, pl. 175.
? Belona indica, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. 1821, p. 131.
Belone annulata, *Cuv. & Val.* xviii. p. 447, pl. 550; *Cant. Mal. Fish.* p. 244; *Day, Fish. Malabar*, p. 165.
Belone gigantea, *Schleg. Faun. Japon. Poiss.* p. 245; *Bleek. Act. Soc. Sc. Indo-Nederl.* iii. *Japan*, p. 21.
? —— melanurus, *Bleek. Verhand. Batav. Genootsch.* xxii. *Madur.* p. 11.
? —— cylindrica, *Bleek, Verhand. Batav. Genootsch.* xxiv. *Snoek.* p. 13.
Belone brachyrhynchus, *Bleek. Nat. Tydschr. Ned. Ind.* vi. p. 61 (young).
Mastacembelus choram, *Bleek. Nederl. Tydschr. Dierk.* iii.
—— brachyrhynchus, *Bleek. l. c.* (young).

D. 23–24. A. 21–22.

The free portion of the tail is tetrahedral, higher than broad, with a slight, narrow longitudinal keel along the side. The length of the head is contained thrice and a third in the total (without caudal); its upper surface with a broad and very shallow median groove; superciliary region striated; base of the intermaxillaries depressed, maxillary nearly entirely hidden by the præorbital. Teeth strong; vomerine teeth none. The diameter of the eye is two-thirds of the width of the interorbital space, and *two-fifths of the length of the postorbital portion of the head*. Body slightly compressed, its depth being much less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. *Tongue covered with tubercular asperities*. Ventral fin midway between the front margin of the eye and the root of the caudal. The middle and hinder dorsal rays are very slender and somewhat prolonged, the last extending nearly or quite to the root of the caudal. Caudal fin forked. Scales very thin and minute, deciduous.

Indian Ocean. Friendly Islands.

a–c. Adult and young: skins. Pinang. From Dr. Cantor's Collection.

d. Half-grown. China. Presented by Admiral Sir E. Belcher.
e. Adult. Formosa. From Consul Swinhoe's Collection.
f–g. Adult. From the Haslar Collection.
h. Adult. From Dr. Bleeker's Collection, as *Belone choram* (=*gigantea*).
i. Young. Gilolo. From Dr. Bleeker's Collection: type of *Belone brachyrhynchus*.

14. Belone melanostigma.

Cuv. & Val. xviii. p. 450.

D. 24. A. 25.

Beak very short, the length of the head being two-ninths of the total (with the caudal). The hinder dorsal and anal rays are prolonged. Teeth extremely small. Sides with three large black blotches and numerous dots. (*Val.*)

Red Sea.

15. Belone caribbæa.

Belone carribæa, *Lesueur, Journ. Acad. Nat. Sc.* ii. 1821, p. 127; *Cuv. & Val.* p. 430.

D. 23–24. A. 21–22. P. 12.

The free portion of the tail is somewhat depressed, and provided with a very slight longitudinal keel on each side. The length of the head is one-third of the total (without caudal). Teeth of moderate size. Upper jaw shorter than lower; the diameter of the eye is rather less than the width of the interorbital space, and two-fifths of the length of the postorbital portion of the head. The length of the pectoral equals the distance of the opercular margin from the orbit. Ventral fin nearer to the head than to the caudal. The middle and hinder dorsal rays are somewhat prolonged, and form a lobe as deep as, or deeper than, the anterior one; the last ray extends nearly to the root of the caudal. Posterior anal rays not produced. Caudal fin forked. Scales minute.

West Indies.

a–b. Adult. Dominica. Purchased of Mr. Cutter.
c–h. Adult, half-grown, and young: skins. Jamaica. From Mr. Parnell's Collection.
i–k. Two and a half inches long. New Orleans.

16. Belone gerania.

Cuv. & Val. p. 437.

D. 25. A. 21.

Beak very thick and short. Eye large, its diameter being more than one-half of its distance from the opercular margin; interorbital space wide. The lower or posterior part of the præorbital is longer and broader than the upper or anterior. Caudal fin forked. (*Val.*)

Martinique.

17. Belone cantrainii.

Tylosurus cantrainii, *Cocco, Lett. in Giorn. Sc. Lett. Sicil.* xvii. p. 18, tab. 1. fig. 4; *Bonap. Faun. Ital. Pesc.*
Belone cantrainii, *Cuv. & Val.* xviii. p. 418.

D. 23. A. 24. P. 12. V. 6.

The free portion of the tail is depressed, with a longitudinal keel on each side. The length of the head is contained thrice and one-third in the total (without caudal). Teeth of moderate size. Upper jaw shorter than lower; diameter of the eye two-fifths of the length of the postorbital portion of the head. The length of the pectoral is rather more than the distance of the opercular margin from the orbit. Ventral fin nearer to the head than to the caudal. The middle and hinder dorsal rays are prolonged, and form a lobe longer than the anterior one; the last extends to or beyond the root of the caudal. Posterior anal rays not produced. Caudal fin forked.

Sicily.

b. *The middle and posterior dorsal rays are short, subequal in length.*

18. Belone ferox.

D. 21. A. 26.

The free portion of the tail is not compressed, subtrihedral, the back of the tail being broad and depressed. The length of the head is less than one-third of the total (without caudal); its upper surface with a broad median groove, tapering behind and widening in front; superciliary region striated; base of the intermaxillaries depressed; only the basal half of the maxillary is hidden by the præorbital. Jaws and teeth strong; vomerine teeth none; tongue smooth. The diameter of the eye is two-thirds of the width of the interorbital space, and two-sevenths of the length of the postorbital portion of the head. Body compressed, its depth being less than the length of the pectoral fin, which exceeds the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the front margin of the orbit. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin truncate. Scales thin and rather small, adherent.

New South Wales.

a. Thirty-one inches long. Sydney. Purchased of Mr. Ross.

19. Belone robusta.

D. 19–20. A. 22.

The free portion of the tail is compressed, much higher than broad; lateral line terminating in a very slight keel. The length of the head is somewhat more than one-third of the total (without caudal); its upper surface striated, without median groove; base of the intermaxillaries depressed, maxillary nearly entirely hidden by

the præorbital. Teeth of moderate size; vomerine teeth none. The diameter of the eye is somewhat more than one-half of the width of the interorbital space, and contained twice and three-fourths in the length of the postorbital portion of the head. Body compressed, its depth being about equal to the length of the pectoral fin, or to the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the front margin of the orbit. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales thin and very small, adherent.

Red Sea.

a. Thirty-one inches long: stuffed. Red Sea. Presented by J. Burton, Esq.

b. Thirty inches long: dried. Egypt. Purchased of M. Parzudaki.

20. Belone liuroides.

Belone leiuroides, *Bleek. Nat. Tydschr. Ned. Ind.* i. p. 479; or *Verh. Bat. Gen.* xxiv. *Snoek. Visch.* p. 25.

Mastacembelus leiuroides, *Bleek. Nederl. Tydschr. Dierk.* iii.

D. 19. A. 22.

The free portion of the tail is slightly depressed, as high as broad; lateral line not terminating in a keel. The length of the head is two-fifths of the total (without caudal); its upper surface deeply striated, with a rather shallow median groove; base of the intermaxillaries strongly depressed, maxillary three-fourths hidden by the præorbital. Teeth of moderate size; vomerine teeth none; tongue smooth. The diameter of the eye is three-fourths of the width of the interorbital space, and two-fifths of the length of the postorbital portion of the head. Body subcylindrical, its depth being much less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the front margin of the orbit. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal; anterior rays very long. Caudal fin forked. Scales thin, not very small, adherent.

East-Indian archipelago.

a. One of the typical specimens. From Dr. Bleeker's Collection.

21. Belone natalensis.

D. 17–18. A. 24.

The free portion of the tail is not compressed, subtrihedral, the back of the tail being broad and depressed. The length of the head is nearly one-third of the total (without caudal); its upper surface with a broad, shallow median groove, tapering behind, widening in

front; superciliary region faintly striated; base of the intermaxillaries depressed, maxillary two-thirds hidden by the præorbital. Teeth of moderate size; vomerine teeth none; tongue smooth. The diameter of the eye is less than the width of the interorbital space, and contained twice and two-thirds in the length of the postorbital portion of the head. Body compressed, its depth being less than the length of the pectoral fin, which exceeds the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the front margin of the orbit. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin truncate. Scales thin and rather small, adherent.

Eastern coast of Africa.

a–b. Fine specimens, 20 inches long. Port Natal. From Mr. Ayres's Collection.

c–d. Half-grown. From the Haslar Collection.

22. Belone truncata.

Timucu, *Marcgr.* p. 168.
Esox, *Schöpf, Schrift. Ges. ntrf. Freund.* viii. p. 177.
Esox belone, *Mitch. Lit. & Phil. Trans. New York*, i. p. 443.
? Esox longirostris, *Mitch. Amer. Month. Mag.* ii. 1817, p. 322.
Belone truncata, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. 1821, p. 126, with a plate; *Storer, Report Massach. Fish.* p. 98; *Dekay, New York Fauna. Fish.* p. 227, pl. 35. fig. 112; *Cuv. & Val.* xviii. p. 422.
—— almeida, *Quoy & Gaim. Voy. Freyc. Zool.* p. 226.
—— guianensis, *Schomburgk, Fish. Guian.* ii. pl. 1.
—— timucu, *Cuv. & Val.* xviii. p. 426; ? *Gnichen. in Ramon de la Sagra, Hist. Nat. Cuba, Poiss.* p. 150, pl. 4. f. 1.
—— scrutator, *Girard, Proc. Ac. Nat. Sc. Philad.* 1858, p. 170; and *U. S. & Mex. Bound. Survey. Ichthyol.* p. 30, pl. 13.
Tylosurus guianensis, *Müll. & Trosch., in Schomb. Reis. Brit. Guian.* iii. p. 626.

D. 15–16. A. 17–19. P. 12. (northern specimens).
13–14. 16–17. (southern specimens).

The free portion of the tail is moderately depressed, broader than deep, without a lateral keel. The length of the head is a little more than one-third of the total (without caudal); its upper surface flat, with a broad and rather shallow, scaly median groove; parietal region faintly striated; base of the intermaxillaries depressed, maxillary only half hidden by the præorbital. Teeth of moderate size; vomerine teeth none. The diameter of the eye is less than the width of the interorbital space, and one-third or a little less than one-third of the length of the postorbital portion of the head. Body broad, subcylindrical, its depth being considerably less than the length of the pectoral fin, which is about equal to the distance of the opercular margin from the orbit. Ventral fin somewhat nearer to the head than to the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating

at a considerable distance from the root of the caudal. Caudal fin obliquely truncate. Scales very thin and small, and deciduous.
Coasts of America.

a. Northern specimens have generally the superciliary region faintly striated, and D. 15–16, A. 17–19: *B. truncata*.

a. Adult. North America. Purchased of Mr. Warwick.
b. Adult. New Orleans. Purchased of Mr. Cuming.
c. Half-grown. Lake Champlain. Purchased of M. Parzudaki.
d–e. Half-grown: skins. Jamaica.
f–g. Half-grown. Bahia. From Dr. O. Wucherer's Collection. These specimens agree more with the North American form, than with the South American.

β. Southern specimens have generally the superciliary region smooth, and D. 13–14, A. 16–17: *B. guianensis*.

h, i, k. Adult and young. Demerara.
l. Adult. Surinam.
m. Adult.

23. Belone subtruncata.

Poey, Mem. Cub. ii. p. 295.

D. 17. A. 16.

Body as broad as deep; the length of the head is contained twice and six-sevenths in the total (with the caudal); diameter of the eye two-fifths of the length of the postorbital portion of the head. Beak slender, with small and fine teeth. Scales invisible. The anal fin commences a little in advance of the dorsal; caudal subtruncate. (*Poey*.)
Cuba.

24. Belone caudimaculata.

Belone caudimaculata, *Cuv. Règne Anim.*; *Cuv. & Val.* xviii. p. 452.

D. 13. A. 15–16.

The free portion of the tail is compressed, much deeper than broad. The length of the head is contained twice and a third in the total (without caudal); its upper surface flat, with a rather shallow median groove of moderate width; superciliary region with one or two striæ; base of the intermaxillaries depressed, maxillary only half hidden by the præorbital. Teeth rather small; vomerine teeth none. The diameter of the eye equals the width of the interorbital space, and is contained twice and three-fourths in the length of the postorbital portion of the head. Body broad, subcylindrical, its depth being considerably less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin midway between the eye and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin rounded. Scales rather small, adherent. A small round deep-black spot on the root of the caudal fin.
Indian Ocean to Australia.

a. Adult. Amboyna. Purchased of Mr. Frank.

b. Adult: skin. Port Essington.
c. Adult. From the Haslar Collection.
d. Half-grown. From the Collection of the Zoological Society.
e, f. Adult.

25. Belone strongylurus.

Russell, ii. pl. 176.
Belone caudimaculata, *Cant. Catal.* p. 246; *Bleek. Verhand. Batav. Genootsch.* xxiv. *Snoek.* p. 12 (not *Cuv.*).
Mastacembelus strongylurus (*v. Hass.*), *Bleek. Ned. Tydschr. Dierk.* iii. (not synon.).

D. 13–14. A. 16.

The free portion of the tail is compressed, much deeper than broad. The length of the head is contained twice and a half or twice and four-fifths in the total (without caudal); its upper surface flat, with a rather shallow median groove of moderate width; superciliary region striated; base of the intermaxillaries depressed, maxillary only one-third hidden by the præorbital. Teeth rather small; vomerine teeth none. The diameter of the eye equals the width of the interorbital space, and is one-third or rather less than one-third of the length of the postorbital portion of the head. Body broad, subcylindrical, its depth being considerably less than the length of the pectoral fin, which equals the distance of the opercular margin from the orbit. Ventral fin nearly midway between the eye and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin rounded. Scales rather small, adherent. A small, round, deep-black spot on the root of the caudal fin.

Indian and Chinese seas.

a, b, c, d–g. Adult (10–11 inches long), half-grown and young. China. Presented by J. R. Reeves, Esq.
h. Adult: skin. Pinang. From Dr. Cantor's Collection.
i–l. Half-grown. India. Presented by G. R. Waterhouse, Esq.
m. Adult: bad state.
n. Young. From the Haslar Collection.

This species is very closely allied to *B. caudimaculata*, but has always the head shorter and the eye comparatively smaller.

26. Belone macrolepis.

Belone macrolepis, *Bleek. Nat. Tydschr. Ned. Ind.* xii. p. 225.
Mastacembelus macrolepis, *Bleek. Ned. Tydschr. Dierk.* iii.

D. 13. A. 16.

The free portion of the tail is compressed, deeper than broad. The length of the head is contained twice and two-fifths in the total (without caudal); its upper surface is flat, with a rather shallow median groove of moderate width; superciliary region with one or two striæ; base of the intermaxillaries strongly depressed, maxillary

two-thirds hidden by the præorbital. Teeth rather small; vomerine teeth none; tongue smooth. The diameter of the eye is two-thirds of the width of the interorbital space, and one-third of the length of the postorbital portion of the head. Body rather compressed, its depth being less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit, and one-sixth of the distance between the opercular margin and the extremity of the caudal. Ventral fin midway between the front margin of the eye and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin rounded. Scales of moderate size, in about 120 transverse series. No black spot on the root of the caudal fin.

Nias.

a. Type of the species, 16 inches long. From Dr. Bleeker's Collection.

27. Belone urvillii.

Cuv. & Val. xviii. p. 444.

D. 13. A. 15.

Body short, beak long, the length of the head being contained twice and two-thirds in the total (with the caudal). Teeth slender and very pointed. Præorbital scaly. Pectoral fin long and pointed, its length being one-fifth of the distance between the opercular margin and the extremity of the caudal. Caudal fin rounded. Scales well developed. (*Val.*)

Vanicolo.

28. Belone capensis.

D. 14. A. 15.

The free portion of the tail is compressed, deeper than broad. The length of the head is two-fifths of the total (without caudal); its upper surface flat, with a very shallow and broad median groove; superciliary region striated; base of the intermaxillaries depressed, maxillary two-thirds hidden by the præorbital. Teeth rather small, widely set; vomerine teeth none. The diameter of the eye is less than the width of the interorbital space, and one-third of the length of the postorbital portion of the head. Body broad, sub-cylindrical. The length of the pectoral fin exceeds the distance of the opercular margin from the orbit. Ventral fin rather small, nearly midway between the eye and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a short distance from the root of the caudal; basal portion of the anal naked. Caudal fin slightly emarginate. Scales of moderate size.

Cape of Good Hope.

a. Eleven inches long. Cape of Good Hope.

b. Thirteen inches long: stuffed. Cape of Good Hope. From Sir A. Smith's Collection.

29. Belone notata.

Poey, Mem. Hist. Nat. Cub. ii. 1860, p. 293.

D. 13–14. A. 14.

The free portion of the tail is compressed, deeper than broad. The length of the head is two-fifths of the total (without caudal); its upper surface flat, with a deep scaly median groove; superciliary region striated; base of the intermaxillaries depressed, maxillary hidden by the præorbital. Teeth of moderate size, widely set; vomerine teeth none. The diameter of the eye is less than the width of the interorbital space, and two-fifths of the length of the postorbital portion of the head. Body broad, subcylindrical. The length of the pectoral fin equals the distance of the opercular margin from the orbit. Ventral fin very small, nearly midway between the head and the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal; basal portion of the anal scaly. Caudal fin slightly emarginate. Scales of moderate size, or rather large when compared with the other species.

Cuba, Jamaica.

a. Fourteen inches long: skin. Jamaica. From Mr. Parnell's Collection.

3. *The free portion of the tail is strongly compressed; lateral line without keel.*

a. *No teeth on he palate.*

30. Belone hians.

Cuv. & Val. xviii. p. 432, pl. 548.

D. 26. A. 27. P. 14. V. 6.

Body and tail strongly compressed. The length of the head is one-fourth of the total (with the caudal). Teeth small. Upper jaw scarcely shorter than lower; intermaxillaries compressed and curved at the base. Fins falciform; the length of the pectoral is more than the distance of the opercular margin from the orbit. The middle and hinder dorsal rays somewhat prolonged, the last extending to the root of the caudal; ventral inserted a little before the middle of the total length. Caudal fin deeply forked. Scales small, adherent. (*Val.*)

West Indies, Bahia.

Belone maculata, Poey, Mem. Cub. ii. p. 290, appears to be very closely allied to *B. hians*. Poey says that it has the lower jaw longer than the upper, the ventral fin inserted behind the middle of the length of the body, and the caudal moderately emarginate. A series of large blue patches from the middle of the side to the tail. *B. hians* would not appear to occur in Cuba, according to Poey.

31. Belone latimanus.

Belone latimana, *Poey, Mem. Cub.* ii. p. 292.

D. 25. A. 23.

Beak and body elongate; the length of the head is a little less than one-third of the total (without caudal). The middle and posterior dorsal rays not prolonged; caudal forked. (*Poey.*)

Cuba.

32. Belone raphidoma.

Belone raphidoma, *Ranzani, Nov. Comm. Acad. Sc. Inst. Bonon.* v. 1842, p. 359, tab. 37. fig. 1.

—— crassa, *Poey, Mem. Cub.* ii. p. 291.

D. 22. A. 22. Vert. 57/27. (*Poey.*)

Tail not depressed. The length of the head one-third of the total (without caudal). Teeth of moderate size; upper jaw shorter than lower; the diameter of the eye is a little less than one-half of the length of the postorbital part of the head, which equals that of the pectoral fin. Ventral fin midway between eye and root of the caudal. The middle and hinder dorsal and anal rays are short and subequal in length, the last dorsal ray terminating at a short distance from the caudal. The origin of the dorsal is opposite to that of the anal. Caudal forked. Scales very small. (*Ranz.*)

Brazil (*Ranzani*); Cuba (*Poey*).

33. Belone melanochir.

Belone melanochir, *Poey, Mem. Cub.* ii. p. 294.

D. 23. A. 20.

The length of the head is contained thrice and one-third in the total (with the caudal); beak feeble, armed with long and slender teeth. Scales minute. Pectorals short, broad; dorsal and anal fins commence opposite to each other and have the middle and posterior rays not prolonged. Caudal forked. Posterior half of the pectorals black. (*Poey.*)

Cuba.

34. Belone anastomella.

Belone anastomella, *Cuv. & Val.* xviii. p. 446.

—— ciconia, *Richards. Ichthyol. Chin.* p. 264.

D. 17–19. A. 22–25.

Tail strongly compressed, much deeper than broad. The length of the head is contained thrice and a fourth in the total (without caudal): its upper surface with a wide and rather deep median groove; superciliary and occipital regions striated; base of the intermaxillaries depressed, maxillary two-thirds hidden by the præorbital. Teeth strong; vomerine teeth none; tongue smooth. The diameter of the eye is much less than the width of the interorbital space, and *one-fourth of the length of the postorbital portion of the head.* Body strongly compressed, its depth being less than the length

of the pectoral, which, again, is somewhat less than the distance of the opercular margin from the orbit. Ventral fin nearer to the head than to the root of the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin emarginate. Scales very thin and small, deciduous; there are about sixteen longitudinal series between the origin of the dorsal fin and the lateral line.

Coasts of China and Japan.

a. Twenty-seven inches long. Shanghai. Purchased of Mr. Jamrach.
b–c. Adult. China. Presented by J. R. Reeves, Esq.
d. Adult: stuffed. China. Presented by J. R. Reeves, Esq.
e–f. Adult. Japan. Purchased of Mr. Jamrach.
g. Half-grown. India. Presented by J. R. Waterhouse, Esq.

35. Belone liurus.

Belone leiurus, *Bleek. Nat. Tydschr. Ned. Ind.* i. p. 94; or *Verh. Bat. Gen.* xxiv. *Snoek. Vissch.* p. 13.
? Belone tenuirostris, *Blyth, Journ. As. Soc. Beng.* 1859. p. 287.
Mastacembelus anastomella, *Bleek. Ned. Tydschr. Dierk.* iii. (not *Cuv. & Val.*).

D. 18–19. A. 23–24.

The free portion of the tail is compressed, much deeper than broad. The length of the head is one-third of the total (without caudal): its upper surface with a rather shallow median groove which widens in front; superciliary and parietal regions coarsely striated; base of the intermaxillaries depressed, maxillary two-thirds hidden by the præorbital. Teeth strong, bent backwards; vomerine teeth none; tongue smooth. The diameter of the eye is two-thirds of the width of the interorbital space, and two-sevenths of the length of the postorbital portion of the head. Body strongly compressed, its depth being less than the length of the pectoral, which equals the distance of the opercular margin from the orbit. Ventral fin midway between the hind margin of the eye and the root of the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin subtruncate. Scales not very small; there are about twelve longitudinal series between the dorsal fin and the lateral line.

East-Indian archipelago.

a. One of the typical specimens, 23 inches long. From Dr. Bleeker's Collection.

36. Belone krefftii.

D. 17. A. 19. P. 13.

The free portion of the tail is strongly compressed, much deeper than broad. The length of the head is contained twice and two-

fifths in the total (without caudal); a scaly groove of moderate width runs along the middle of its upper surface; superciliary region slightly striated; base of the intermaxillaries much depressed, maxillaries two-thirds hidden by the præorbital. Teeth rather feeble, widely set; tongue smooth. The diameter of the eye equals the width of the interorbital space, and is one-third of the length of the postorbital portion of the head. Body strongly compressed, its depth being not much less than the length of the pectoral fin, which, again, is somewhat less than the distance of the opercular margin from the orbit. Ventral fin midway between præoperculum and caudal. Origin of dorsal fin opposite to that of anal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at some distance from the root of the caudal; anterior anal rays longer than anterior dorsal rays. Caudal fin slightly emarginate. Scales thin and small. Upper parts blackish, sides and belly silvery-white, the two colours being separated by a narrow greenish streak.

Australia.

a. Fourteen inches long. From Mr. G. Krefft's Collection (508).

37. Belone acus.

Aguglia, Aguja.

Acus, *Rondel.* i. p. 257; *Gesner, Aquat.* iv. p. 9; *Salv.* p. 68. fig. 8; *Aldrov. de Pisc.* p. 106.

Esox belone, *Brünn. Ichthyol. Mass.* p. 79; *Risso, Ichth. Nice*, p. 330; *Nacc. Itt. Adr.* p. 18; *Nard. Prodr. Adr. Ichth.* no. 143.

Belone acus, *Risso, Eur. Mérid.* iii. p. 443; *Bonap. Faun. Ital.*; *Cuv. & Val.* xviii. p. 414.

D. 17. A. 21. P. 12.

Tail compressed, deeper than broad. The length of the head is two-sevenths of the total (without caudal); its upper surface without median groove; superciliary and parietal regions striated; base of the intermaxillaries convex, not compressed; maxillary entirely hidden by the præorbital. Teeth exceedingly small; vomerine teeth none. Upper jaw a little shorter than lower. The diameter of the eye equals the width of the interorbital space, and is two-fifths of the length of the postorbital portion of the head. Body compressed, its depth being nearly equal to the length of the pectoral fin, the length of which is a little less than the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the opercular margin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales very thin and deciduous, irregular, and not very small.

Mediterranean.

a. Adult. Malta.

b. Adult. Nice. From the Berlin Museum.

c. Half-grown. Mediterranean.

38. Belone gracilis.

? Belone gracilis, *Lowe, Proc. Zool. Soc.* 1839, p. 86, and *Trans. Zool. Soc.* iii. p. 13.

Closely allied to *B. euxini* and *B. acus*, but with the head longer.

D. 17. A. 21. P. 12.

The free portion of the tail is compressed, much deeper than broad. The length of the head is contained twice and three-fourths in the total (without caudal); its upper surface flat, without median groove; superciliary and parietal regions striated; base of the intermaxillaries convex, slightly compressed; maxillary entirely hidden by the præorbital. Teeth small, but considerably larger than in *B. acus*; vomerine teeth none. Upper jaw much shorter than lower. The diameter of the eye equals the width of the interorbital space, and is two-fifths of the length of the postorbital portion of the head. Body compressed, its depth being somewhat less than the length of the pectoral fin, the length of which is more than the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the opercular margin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales very thin and deciduous, irregular and small.

Coast of Portugal; ? Madeira.

a. Eighteen inches long. Lisbon.
b. Ten inches long. From the Haslar Collection.
c. Eleven inches long. Purchased of Mr. Damon.

39. Belone euxini.

Esox belone, *Pall. Zoogr. Ross.-As.* iii. p. 337.
? Belone rostrata, *Nordm. in Demid. Voy. Russ. Mérid.* iii. p. 314, pl. 25. fig. 1; *Kessler, Bull. Soc. Nat. Mosc.* 1859, ii. p. 454 (not *Faber*).

D. 17. A. 21. P. 12.

The free portion of the tail compressed, deeper than broad. The length of the head is a little less than one-third of the total (without caudal); its upper surface without median groove; superciliary and parietal regions striated; base of the intermaxillaries convex, slightly compressed, maxillary nearly entirely hidden by the præorbital. Teeth small, but considerably larger than in *B. acus*; vomerine teeth none. Upper jaw much shorter than lower. The diameter of the eye equals the width of the interorbital space, and is two-fifths of the length of the postorbital portion of the head. Body compressed, its depth being nearly equal to the length of the pectoral fin, the length of which is a little less than the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the opercular margin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the

caudal. Caudal fin forked. Scales very thin and deciduous, irregular and small.

Black Sea.

a. Fifteen inches long. From Mr. Millingen's Collection.

This species is very similar to *B. acus*, but may be readily distinguished by its much larger teeth.

40. Belone cancila.

Esox cancila, *Buch. Ham.* pp. 214, 380, pl. 27. fig. 70.
Belone graii, *Sykes, Trans. Zool. Soc.* ii. p. 367, pl. 63. fig. 4.
—— cancila, *Cuv. & Val.* xviii. p. 455; *Bleek. Verh. Bat. Genootsch.* xxv. p. 145; *Day, Fish. Malabar*, p. 166.

D. 16–17. A. 17. Vert. 36/22.

The free portion of the tail is compressed, deeper than broad. The length of the head is two-fifths of the total (without caudal); a deep groove of moderate width runs along the middle of its upper surface; superciliary region smooth; base of the intermaxillaries depressed, maxillary two-thirds hidden by the præorbital. Teeth strong, widely set; vomerine teeth none. The diameter of the eye is nearly equal to the width of the interorbital space, and two-fifths of the length of the postorbital portion of the head. Body broad, subcylindrical, its depth being considerably less than the length of the pectoral fin, which, again, is less than the distance of the opercular margin from the orbit. Ventral fin midway between eye and caudal; origin of dorsal fin opposite to that of anal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at some distance from the root of the caudal. Caudal fin subtruncate. Scales very thin and small.

Indian Ocean.

a, *b*, *c*, *d–f*. Fine specimens. Ceylon.
g. Adult: skeleton. Ceylon. Purchased of Mr. Cutter.

41. Belone canciloides.

Belone canciloides, *Bleeker, Nat. Tydschr. Ned. Ind.* v. p. 454.
Mastacembelus canciloides, *Bleek. Ned. Tydschr. Dierk.* iii.

D. 17. A. 17–18.

The free portion of the tail is strongly compressed, deeper than broad. The length of the head is two-fifths of the total (without caudal). Base of the intermaxillaries depressed. The diameter of the eye is one-third of the length of the postorbital portion of the head, which is more than that of the pectoral fin. The first dorsal ray is opposite the third or fourth of the anal fin. The middle and hinder dorsal and anal rays short. Caudal fin subtruncate. Scales small.

Rivers of Borneo.

a. One of the typical specimens, 11 inches long. From Dr. Bleeker's Collection.

42. Belone senegalensis.

Cuv. & Val. xviii. p. 421.

D. 15. A. 15–16. P. 11.

The free portion of the tail is compressed, deeper than broad. The length of the head is two-fifths of the total (without caudal); its upper surface flat, with a broad, shallow, scaly median groove; superciliary region faintly striated; base of the intermaxillaries depressed, maxillary only half hidden by the præorbital. Teeth of moderate size; vomerine teeth none. The diameter of the eye is less than the width of the interorbital space, and contained twice and three-quarters in the length of the postorbital portion of the head. Body broad, subcylindrical, its depth being considerably less than the length of the pectoral fin, which is more than the distance of the opercular margin from the orbit. Ventral fin somewhat nearer to the head than to the caudal. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin emarginate. Scales very thin, rather small, and deciduous.

West Africa.

a. Adult. Sierra Leone.

b. *Teeth on the palate.*

43. Belone vulgaris.

Gar-fish, Gar-pike; Horn-fish, Horn-hecht; l'Orphie; Näbbgädda.
Will. Hist. Pisc. p. 231 (tab. P. 2. fig. 4); *Penn. Brit. Zool.* iii. p. 283, pl. 63, and, edit. 1812, iii. p. 429, pl. 74; *Couch, Brit. Fish.* iv. p. 146, pl. 209.
Esox, sp., *Gronov. Zoophyl.* no. 362; *Mus. Ichth.* i. p. 10, no. 30.
Esox belone, *L. Syst. Nat.* i. p. 517; *Bl.* taf. 33; *Bl. Schn.* p. 391; *Lacép.* v. p. 308; *Müll. Faun. Dan.* p. 49; *Donov. Brit. Fish.* iii. pl. 64; *Turton, Brit. Faun.* p. 105.
Mastaccembelus, sp., *Klein, Pisc. Miss.* iv. tab. 3. fig. 2.
Belone vulgaris, *Flem. Brit. An.* p. 184; *Jen. Man.* p. 418; *Ekström, Fische Mörkö*, p. 72; *Parnell, Wern. Mem.* vii. p. 274; *Yarrell, Brit. Fish.* i. p. 391, 2nd edit. i. p. 442, 3rd edit. i. p. 459; *Cuv. & Val.* xviii. p. 399; *Nilss. Skand. Faun. Fisk.* p. 359.
—— rostrata, *Faber, Fische Isl.* p. 152; *Kröyer, Danm. Fisk.* iii. p. 257.
Macrognathus scolopax, *Gronov. Syst.* ed. *Gray*, p. 147.

Young.

Hemirhamphus europæus, *Yarr. Mag. Nat. Hist.* 1837, p. 505, and *Brit. Fish.* 2nd ed. i. p. 450, 3rd ed. i. p. 469; *Couch, Zoologist*, 1848, p. 1978. figs. *d* & *e*, and *Brit. Fish.* iv. p. 135, pl. 208.
Esox brasiliensis ?, *Couch, Trans. Linn. Soc.* xiv. p. 85.
Hemirhamphus obtusus, *Couch, Zoologist*, p. 1978, figs. *a–c*, and *Brit. Fish.* iv. p. 139, pl. 208.
—— balthicus, *Hornschuch.*
—— behnii, *Van der Hoeven.*
Cf. a paper by *Malm*, Öfvers. Vetensk. Akad. Förhandl. 1852, tab. 3, where the author proves the identity of these fishes with *Belone.*

B. 12. D. 17–19. A. 21–22. P. 12. V. 6. Vert. 52/28.

Tail compressed, deeper than broad. The length of the head is two-sevenths of the total (without caudal); its upper surface without median groove; superciliary region faintly striated; base of the intermaxillaries somewhat compressed, maxillary entirely hidden by the præorbital. Teeth very small; vomerine teeth present, forming a small, short, ovoid patch. The diameter of the eye is less than the width of the interorbital space, and contained twice and two-thirds in the length of the postorbital portion of the head. Body compressed, its depth being nearly equal to the length of the pectoral fin, which is but little less than the distance of the opercular margin from the orbit. Ventral fin nearly midway between root of the caudal and opercular margin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales very thin and small, deciduous.

Northern coasts of Europe.

a. Adult. English coast. Presented by Messrs. Gibson and Quelch. This specimen has lost the vomerine teeth.

b–g. Adult: skins in bad state. Firth of Forth. From Mr. Parnell's Collection.

h. Adult. Old Collection.

i. Four and a half inches long. Cornwall. Presented by J. Couch, Esq., as *Hemirhamphus europæus*.

k–l. Three inches long. Bohuslän. Presented by Hr. A. W. Malm.

44. Belone cornidii.

Aguja paladar, *Cornide, Peces Galic.* p. 88.

B. 12. D. 16. A. 19–21. P. 13. V. 6.

Very similar to *B. vulgaris*.

Tail compressed, deeper than broad. The length of the head is a little less than one-third of the total (without caudal); its upper surface without median groove; superciliary region faintly striated; base of the intermaxillaries scarcely compressed, maxillary entirely hidden by the præorbital. Teeth more numerous and considerably stronger than in *B. vulgaris*; vomerine teeth present, forming a longish band, tapering posteriorly. The diameter of the eye is scarcely less than the width of the interorbital space, and contained twice and two-thirds in the length of the postorbital portion of the head. Body compressed, its depth being nearly equal to the length of the pectoral fin, which is but little less than the distance of the opercular margin from the orbit. Ventral fin nearly midway between the root of the caudal and the opercular margin. The middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from the root of the caudal. Caudal fin forked. Scales very thin and deciduous, but larger than in *B. vulgaris*.

Coast of Portugal.

a. Twenty inches long. Lisbon. Presented by the Rev. R. T. Lowe.

b. Adult. Atlantic. From the Berlin Museum (as *B. argalus*).

B. *Dorsal rays subequal in length, the anterior ones not forming a lobe.*
Potamorrhaphis.

45. Belone tæniata.

B. 7–8. D. 30. A. 25. P. 7. V. 6. L. lat. 180.

Trunk tetrahedral, as broad as deep; tail strongly compressed; crown of the head quite flat; a median longitudinal groove commences between the eyes and runs forward to the base of the intermaxillaries, where it is continued as a linear furrow. Beak broad, strongly depressed, the lower jaw being broader and somewhat longer than the upper. The length of the head is one-third of the total (with the caudal); the diameter of the eye is less than the width of the interorbital space, and two-fifths of the length of the postorbital part of the head. Jaws armed with a very narrow band of inconspicuous asperities and with a series of small, fine teeth. Maxillary larger and broader than, and only one-half hidden by, the præorbital. Ventral fin midway between the head and caudal. The anterior dorsal rays are not much higher, and scarcely stronger, than the posterior ones, the last terminating at a short distance from the caudal. The anal commences behind the dorsal, and has the anterior rays much stouter and longer than the posterior. Caudal rounded; pectoral a little longer than the postorbital part of the head. Light-brownish, with a broad brownish-black lateral band, running from the snout to the root of the caudal.

Fresh waters of Brazil.

a–c. From 10 to 11 inches long. River Capin. Purchased of Mr. Stevens.

46. Belone scolopacina.

Cuv. & Val. xviii. p. 428.

D. 14. A. 17.

No prominent keel on the sides of the tail. Beak remarkably flattened; skull broad posteriorly, with a very short groove on its upper surface. Superciliary region without striæ, pierced with pores. Eyes large and prominent. Pectorals small, narrow, falciform; the dorsal fin has all the rays of nearly equal length; anterior lobe of the anal rounded; caudal apparently rounded. Scales well developed. (*Val.*)

Mana.

2. SCOMBRESOX.

Scombresox, *Lacép.* v. p. 344.

Both jaws prolonged into a long, slender beak, the upper part being formed by the intermaxillaries; both jaws with a series of extremely minute teeth. Body elongate, compressed, slender, covered with small, thin, deciduous scales. A number of detached finlets behind the dorsal and anal fins. Gill-openings very wide. Intestinal track simple, without pyloric appendages. Air-bladder large.

Atlantic, coast of Chili; New Zealand; Japan.

As in *Belone*, the jaws are not produced in very young fishes, and during growth the lower jaw is much in advance of the upper.

1. Scombresox saurus.

Saury or Skipper.
Lacertus vel Saurus, *Willughby, Hist. Pisc.* p. 232.
Skipper, *Ray, Synops.* p. 165.
Esox saurus, *Walbaum, Artedi*, iii. p. 93; *Bl. Schn.* p. 394, taf. 78. fig. 2; *Rackett, Trans. Linn. Soc.* vii. p. 60, tab. 5; *Turton, Brit. Faun.* p. 105; *Neill, Werner. Mem.* i. p. 541; *Donov. Brit. Fish.* v. pl. 116.
Saury Pike, *Penn. Brit. Zool.* iii. p. 284, pl. 64; or edit. 1812, iii. p. 424, pl. 75; and *Tour Scotl.* 2nd edit. p. 298, taf. 17. f. 2; *Yarr. Brit. Fish.* i. p. 394, and 2nd edit. i. p. 446.
Scomberesox camperii, *Lacép.* v. p. 345, pl. 6. fig. 3; *Cuv. & Val.* xviii. p. 464, pl. 551; *Kröyer, Danm. Fisk.* iii. p. 278; *Thomps. Nat. Hist. Ireland*, iv. p. 142; *Yarr. Brit. Fish.* 3rd edit. i. p. 465; *Nilss. Öfvers. Svensk. Vet. Acad. Förhandl.* 1864, p. 501.
Scomberesox saurus, *Flem. Brit. An.* p. 184; *Parnell, Werner. Mem.* vii. p. 276.
Belone saurus, *Jenyns, Man.* p. 419.
Bill-fish, *Storer, Fish. Massach.* p. 100.
Scomberesox storeri, *Dekay, New York Faun. Fish.* p. 229, pl. 35. fig. 111 (very bad).

Young (2–3 inches long).

Scomberesox scutellatum, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. 1821, p. 132.
Scombresox scutellatus, *Cuv. & Val.* xviii. p. 477.

B. 13. D. 10–11+V–VI. A. 13+VI–VII. P. 12. V. 6. L. lat. 110.

Lower jaw longer than the upper. The length of the head is about two-sevenths of the total (without caudal) in full-grown individuals; but the snout is considerably shorter in young specimens. Base of the ventral fin midway between the root of the caudal and the anterior margin of the eye. The diameter of the eye is contained twice and two-thirds in the length of the postorbital part of the head. Air-bladder present, large.

Atlantic coasts of Europe, Africa, and North America.

a. Adult. Norfolk. Presented by Messrs. Olliff & Co.
b. Adult: skin, bad state. England.
c. Half-grown. Banks of Newfoundland. Presented by W. Winstone, Esq.
d. Half-grown. Cape of Good Hope. Presented by Sir A. Smith.
e–g. Adult and half-grown: skins. Cape of Good Hope. Presented by Sir A. Smith.
h, *i*. Half-grown.

Young examples.

k, *l–p*. From 1½ to 7 inches long. Atlantic, 3° N. of the line. Presented by J. B. Godfrey, Esq.

q–t. From 2 to 4 inches long. Presented by Mr. E. Jones.
u–x. From 1½ to 3 inches long. St. Helena.
y–z. From 2 to 5 inches long. From the Haslar Collection.
α–β. Two inches long. North Atlantic. From Mr. Rouse's Collection.
γ–η. From 1 to 1½ inches long. Lat. 20° N., long. 22° 53′ W. From Dr. Lyall's Collection.

2. Scombresox rondeletii.

Saurus, *Rondel.* i. p. 232.
Acus altera minor, *Bellon. Aquat.* p. 163.
Scombresox camperii, *Risso, Ichth. Nice*, p. 334, and *Eur. Mérid.* iii. p. 444 (not *Lacép.*).
Sayris camperi, *Bonap. Faun. Ital. Pesc.*
Scomberesox saurus, *Valenc. in Cuv. Règne An. Ill. Poiss.* pl. 98. f. 1.
Scomberesox rondeletii, *Cuv. & Val.* xviii. p. 472.
Grammiconotus bicolor, *Costa, Annuario del Museo Zool. della Univers. di Napoli*, 1862, i. p. 55, tav. 1. fig. 4 (very young).

Distinguished from *Sc. saurus* by the absence of the air-bladder.
Mediterranean.

a–c. From 3 to 4 inches long. Mediterranean. Jaws not produced.

3. Scombresox forsteri.

Esox saurus, *Forster, in Bl. Schn.* p. 394, and *Descr. Anim.* ed. *Licht.* p. 143.
Scomberesox forsteri, *Cuv. & Val.* xviii. p. 481.

The only difference which I can observe between the fishes from the Atlantic and Pacific Oceans, is the apparently smaller size of the scales. However, as our New Zealand specimen is not in a good state of preservation, even this is a doubtful character. Thus, for the present, we can only confirm Forster's observation as regards the occurrence of this genus in New Zealand.

a. Seven and a half inches long. New Zealand. Presented by Capt. Stokes.

4. Scombresox equirostrum.

Scomberesox equirostrum, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. p. 132; *Cuv. & Val.* xviii. p. 479.

Both jaws of equal length.
From Chile.

Lesueur describes a stuffed specimen preserved in a collection at Boston, without mentioning the locality where it had been obtained. It is probable that this specimen was caught on the coast of the United States, and not less so that it was merely a *Sc. saurus* deformed by stuffing. If this is really the case, the Chilean fish described by Valenciennes may prove to be a distinct species.

5. Scombresox saira.

Brevoort, in Perry's Narrat. Exped. Chin. & Japan, ii. *Fish.* p. 281, pl. 7. fig. 4.

This fish is known from a figure only; and readily distinguished by having the jaws scarcely produced, the eye being nearly midway between the extremity of the snout and the opercular margin. The fish is represented with five postdorsal, and four postanal finlets.

The drawing is 11¼ inches long, and was made in Japan.

3. HEMIRHAMPHUS*.

Hemirhamphus, *Cuv. Règne Anim.*
Hyporhamphus, *Gill, Proc. Acad. Nat. Sc. Philad.* 1859, p. 131, and 1863, p. 272.
Euleptorhamphus, *Gill, l. c.* p. 156.
Zenarchopterus, Oxyporhamphus, *Gill, l. c.* 1863, p. 273.
Dermatogenys (*K. & v. H.*), *Peters, Monatsber. Akad. Wiss. Berl.* 1865, p. 133.
Hemirhamphodon, etc., *Bleek. Ned. Tydschr. Dierk.* iii. p. 139.

The lower jaw is prolonged into a long, slender beak; the upper is short, the intermaxillaries forming a triangular more or less convex

* 1. Hemiramphus marginatus, *Lesueur, Journ. Ac. Nat. Sc. Philad.* ii. p. 134 (not *Forsk.*).—West Indies.—D. 14. A. 12.
2. —— reynaldi, *C. & V.* xix. p. 39; *Day, Fish. Malabar*, p. 168.—Ceylon, Calcutta.—D. 16. A. 15. Closely allied to *H. dussumierii*.
3. —— xanthopterus, *C. & V.* xix. p. 47; *Day, Fish. Malabar*, p. 161.—Alipey, fresh water.—D. 15. A. 16.
4. —— leucopterus, *C. & V.* xix. p. 48.—Bombay.—D. 16. A. 14.
5. —— lucens, *C. & V.* xix. p. 62.—Moluccas.
6. —— erythrorinchus, *Lesueur, Journ. Ac. Nat. Sc. Philad.* ii. p. 137; *C. & V.* xix. p. 40.—Mauritius.
7. Belone microstoma, *Basilewsky, Nouv. Mém. Soc. Nat. Mosc.* 1855, p. 260.—China.
8. Hemiramphus japonicus, *Brevoort, in Perry's Narrat. Exped. China & Japan*, ii. *Fishes*, p. 280.—Loo Choo.—Known from a figure only.
9. —— depauperatus, *Lay & Benn. in Beechey's Voy. Zool. Fish.* p. 66.—Oahu.—D. 15. A. 13. The typical specimen appears to be lost.
10. —— argenteus, *Bennett, Whaling Voy.* ii. p. 269.—Founded on young specimens taken near the surface of the sea in lat. 3° S., and 5° N., Pacific Ocean.
11. Esox ectuntio, *Buch. Ham. Fish. Gang.* pp. 212, 380; Hemirhamphus ectuntio, *Blyth, Journ. As. Soc. Beng.* 1859, xxvii. p. 287.—Fresh waters of Bengal.—D. 13. A. 11.
12. Esox angulatus, *Buch. Ham. M. S.*; Hemirhamphus brachynotopterus, *Blyth, Journ. As. Soc. Beng.* 1859, xxvii. p. 288 (not *Bleeker*).—Coast of Bengal.
13. Hemirhamphus plumatus, *Blyth, Journ. As. Soc. Beng.* 1859, xxvii. p. 288.—Bengal and Ceylon.—D. 15. A. 13.
14. Euleptorhamphus brevoortii, *Gill, Proc. Acad. Nat. Sc. Philad.* 1859, p. 156.—*Hab.* ——? D. 22. A. 22.
15. Hemirhamphus filamentosus, *Poey, Mem. Cub.* ii. p. 297.—Cuba.—D. 12–14. A. 11–13.
16. —— macrochirus, *Poey, l. c.* p. 299.—Cuba.—D. 11–14. A. 11–12; the length of the pectoral exceeds the height of the body.
17. —— viviparus, *Peters, Monatsber. Akad. Wiss. Berl.* 1865, p. 132.—Samar.—An spec. dist. ab *H. brachynotoptero*?

plate. Both jaws with a narrow band of minute teeth*. Body elongate, slender, covered with scales of large or moderate size. All the dorsal and anal rays connected by a membrane. Gill-openings very wide. Intestinal track simple, without pyloric appendages. Air-bladder large.

Seas between and near to the tropics; many species entering fresh waters.

Very young specimens have the lower jaw not prolonged.

The numerous species may be subdivided thus:—

A. Pectoral short.
- *a.* Caudal forked or emarginate, p. 260.
- *b.* Caudal rounded, p. 272.
  - *aa.* Dorsal rays much more numerous than anal; beak with minute teeth along each edge: *Hemirhamphodon* (Blkr.), p. 272.
  - *bb.* Number of dorsal rays not much exceeding that of anal; dorsal fin commencing before or above the origin of the anal; males with dorsal and anal rays modified. Viviparous: *Zenarchopterus* (Gill), p. 273.
  - *cc.* Anal rays more numerous than dorsal; anal commencing before dorsal fin: *Dermatogenys* (v. Hass.), p. 275.

B. Pectoral elongate.
- *a.* Beak very long: *Euleptorhamphus* (Gill), p. 276.
- *b.* Beak shortened: *Oxyporhamphus* (Gill), p. 276.

A. *Pectoral short.*

a. *Caudal forked or emarginate.*

1. Hemirhamphus intermedius.

Hemirhamphus intermedius, *Cant. Ann. & Mag. Nat. Hist.* 1842, ix. p. 485; *Richards. Ichth. Chin.* p. 264.
Hemirhamphus melanochir, *Cuv. & Val.* xix. p. 41.

D. 15–17. A. 18–20. P. 11.

Scales of moderate size, very deciduous. The length of the entire head is contained twice and three-fourths or twice and four-fifths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) five times and a half. The triangular part of the upper jaw, formed by the intermaxillaries, is longer than broad. The diameter of the eye equals the width of the interorbital space, and is contained once and a half or once and two-thirds in the length of the postorbital part of the head. Præorbital as long as high. The root of the ventral fin is midway between the base of the caudal and that of the pectoral. Dorsal and anal fins scaleless, the origins of both being nearly opposite. Caudal fin emarginate, the

* These teeth are in many species tricuspid, either in both jaws or in the lower only. No systematic value can be attached to such a difference when it is observed in a rudimental organ like the teeth of *Hemirhamphus*.

central rays being much longer than the eye. Back dark greenish; sides with a well-defined silvery band. Pectoral blackish.

Seas of China, Australia, and New Zealand.

a–b, c–d. Adult and half-grown. China. Presented by Sir J. Richardson. D. 15. A. 17–18.

e–f, g–k. Young. Chusan. From Dr. Cantor's Collection.—Types of *H. intermedius*.

l–m. Adult: bad state. Van Diemen's Land. Presented by Dr. Melville. D. 17. A. 20.

n. Twenty inches long: stuffed. South Australia. D. 16. A. 19.

o, p, q–r. Adult and half-grown: not in good state. New Zealand. D. 16. A. 18.

s–t. Adult and half-grown: not in good state. Bay of Islands. From the Haslar Collection. D. 16. A. 19.

u–w. Adult and half-grown: bad state. From the Haslar Collection.

2. Hemirhamphus balinensis.

Hemirhamphus balinensis, *Bleeker, Nat. Tydschr. Ned. Ind.* xvii. p. 170.
—— intermedius, *Bleek. Ned. Tydschr. Dierk.* iii. p. 154 (not syn.).

D. 16. A. 17–19. P. 10–11. L. lat. 60.

The length of the head is contained twice and three-fourths, that of the snout thrice and four-fifths in the total (without caudal); upper jaw broader than long; the length of the prominent part of the lower jaw is contained from four times and two-thirds to six times and one-third in the total. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the length of the postorbital part of the head. Præorbital longer than high. Dorsal and anal fins are entirely opposed to each other. Ventrals inserted anteriorly in the fourth fifth of the total length, with the inner ray shortest. Caudal deeply forked, the central rays being rather shorter than the eye. Body with a silvery lateral band. (*Bl.*)

Sea of Bali.

a. Type of the species. Bali. From Dr. Bleeker's Collection. Dr. Bleeker is in error in considering this species identical with *H. intermedius* (Cant.).

3. Hemirhamphus regularis.

D. 15. A. 17. P. 12. L. lat. 58.

The length of the entire head is a little more than one-third of the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) one-half of the length of the head. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye is rather less than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. Vertex and interorbital space convex. The root of the ventral fin is nearly midway between the front margin of the eye and the base of the caudal. Dorsal and anal fins scaleless, the former a little longer than the latter; they

commence opposite to each other. Caudal fin moderately forked, with the lobes nearly equal in length, the central rays being much longer than the eye. Sides with a well-defined silvery band as broad as a scale.

Australia.

a–e. From 7 to 9 inches long. Australia. Presented by the Earl of Derby.
f–g. Half-grown. Australia. From Mr. Gould's Collection.
h. Adult. West Australia. From Mr. Turner's Collection.

4. Hemirhamphus poeyi.

Hemirhamphus fasciatus, *Poey, Mem. Cub.* ii. p. 299 (not *Blkr.*).

D. 15. A. 17. Vert. 34/18.

The length of the head is contained thrice and two-thirds in the total (with the caudal), that of the lower jaw (beyond the extremity of the upper jaw) eight times. The diameter of the eye is contained thrice and three-fourths in the distance between the extremity of the upper jaw and the opercular margin. The distance of the point of the lower caudal lobe from the root of the ventral is much more than one-half of its distance from the extremity of the upper jaw. The length of the pectoral is less than the height of the body; caudal moderately forked. Dorsal and anal scaly. Sides with a silvery band. (*Poey.*)

Havannah.

5. Hemirhamphus unifasciatus.

Hemirhamphus unifasciatus, *Ranzani, Nov. Comm. Acad. Sc. Inst. Bonon.* v. 1842, p. 326, tab. 25.
Hemirhamphus richardi, *Cuv. & Val.* xix. p. 26.
Hyporhamphus tricuspidatus, *Gill, Proc. Acad. Nat. Sc. Philad.* 1859, p. 131.
Hemirhamphus neglectus, *Bleek. Ned. Tydschr. Dierk.* iii. p. 157.

D. 15 (16). A. 16–17. L. lat. 52–56. Vert. 34/18.

The length of the entire head is contained twice and three-fourths or thrice in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) from five times and a half to six times and a half. The length of the head, without mandible, is contained thrice and a third in that of the trunk, without head and caudal. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. The diameter of the eye is rather less than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. The root of the ventral fin is nearly midway between the eye and the base of the caudal. Dorsal and anal fins scaly, the former a little longer than the latter. Caudal fin moderately forked, the central rays being longer than the eye. Back dark greenish, sides with a well-defined silvery band as broad as a scale.

Atlantic coasts of Tropical America; Pacific coast of Panama; Indian Ocean.

a–b. Adult. St. Croix. Purchased of Mr. Stevens.
c. Half-grown: skin. Jamaica. From Mr. Parnell's Collection.
d. Adult. Rio Janeiro. Presented by A. Fry, Esq.
e–f, g–h. Adult. Pacific coast of Panama. From the Collections of Mr. O. Salvin and Captain Dow.
i. Adult.
k. Adult. Mauritius. From the Collection of the Zoological Society.
l. Adult. East-Indian archipelago. From Dr. Bleeker's Collection. One of the typical specimens of *H. neglectus*.
m–o. Adult. From the Haslar Collection.
p. Adult: skeleton. From the Haslar Collection.

Hemirhamphus picarti (Cuv. & Val. xix. p. 25; Guichen. Explor. Algér. Poiss. p. 95, pl. 6. fig. 1), from the coast of Algeria, must be very closely allied to *H. unifasciatus*.

6. Hemirhamphus gaimardi.

?? Hemirhamphus gaimardi, *Cuv. & Val.* xix. p. 36.
Hemirhamphus gaimardi, *Bleek. Nederl. Tydschr. Dierk.* iii., p. 158.
—— melanurus, *Bleek. Verh. Bat. Gen.* xxiv. *Snoek.* p. 19, and *Nederl. Tydschr. Dierk.* iii. p. 156. (not *Cuv. & Val.*).

D. 15–16. A. 15–16.

Very closely allied to *H. unifasciatus*.

The length of the entire head is one-third of the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) one-seventh or one-sixth. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye equals the width of the interorbital space, and is rather less than two-thirds of the length of the postorbital part of the head. *Præorbital low and long, scarcely shorter than the diameter of the eye.* The root of the ventral fin is nearer to the eye than to the base of the caudal. Dorsal and anal fins with thin scales; the former a little longer than the latter. Caudal fin moderately forked, the central rays being longer than the eye. Back dark greenish, sides with a well-defined silvery band as broad as a scale.

East-Indian archipelago; New Guinea.

a. Adult. From Dr. Bleeker's Collection, as *H. gaimardi*.
b. Adult. From Dr. Bleeker's Collection, as *H. melanurus*.

7. Hemirhamphus roberti.

Hemirhamphus roberti, *Cuv. & Val.* xix. p. 24.

D. 15. A. 16. L. lat. 54.

The length of the entire head is contained twice and three-fourths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) five times and a half. The triangular part of the upper jaw, formed by the intermaxillaries, is as *long as broad*. The diameter of the eye is rather less than the width of the interorbital space, and contained once and two-thirds in the length of the postorbital part of the head. The root of the ventral fin is

midway between the eye and the base of the caudal. Dorsal and anal fins scaly; the former a little longer than the latter. Caudal fin emarginate, the central rays being much longer than the eye. Back dark greenish, sides with a well-defined silvery band not quite as broad as a scale.

Cayenne; Gulf of Mexico.

a. Adult. New Orleans. Purchased of Mr. Cuming.

8. Hemirhamphus georgii.

Hemirhamphus georgii, *Cuv. & Val.* xix. p. 37, pl. 555; *Cant. Catal.* p. 248.

D. 16 (17). A. 15.

The length of the entire head is but little less than one-half of the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) nearly one-third. The triangular part of the upper jaw, formed by the intermaxillaries, is very convex and much longer than broad. The diameter of the eye is less than the width of the interorbital space, and contained once and two-thirds in the length of the postorbital part of the head. The root of the ventral fin is much nearer to the base of the caudal than to the axil of the pectoral. Dorsal and anal fins scaleless, the former longer than the latter. Caudal fin emarginate, the central rays being much longer than the eye. Sides with a well-defined silvery band as broad as a scale.

Indian Ocean and archipelago.

a. Seven inches long. Bengal. From General Hardwicke's Collection.
b. Seven inches long: skin. Pinang. From Dr. Cantor's Collection.

9. Hemirhamphus cantoris.

Hemirhamphus longirostris, *Bleek. Bydr. Topogr. Bat.* (not *Cuv.*).
—— georgii, *Bleek. Verh. Bat. Gen.* xxiv. *Snoek.* p. 19 (not *Cuv. & Val.*).
—— cantori, *Bleeker, Ned. Tydschr. Dierk.* iii. p. 145 (not syn.).

D. 15. A. 15. P. 10. L. lat. 60.

Body compressed, its depth being one-eighth of the distance between the extremity of the upper jaw and the root of the caudal. The length of the entire head is contained twice and one-fifth or twice and two-fifths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) thrice and two-thirds. The triangular part of the upper jaw, formed by the intermaxillaries, is longer than broad, convex. The diameter of the eye is less than the width of the interorbital space, and contained once and two-thirds in the length of the postorbital part of the head. The root of the ventral fin is equidistant from the caudal and the extremity of the pectoral. Dorsal fin scaleless; anal scaly; the former much longer than the latter. Caudal fin deeply forked, the central rays being longer than the eye. Sides with a silvery band, which is broader than a scale; mandibulary fringes broad, deep black.

China seas; East-Indian archipelago.

a–b. Twelve inches long. Amoy. Purchased of Mr. Stevens.
c. Half-grown. China seas. Presented by Vice-Admiral Sir E. Belcher.
d. One of the typical specimens. From Dr. Bleeker's Collection.

10. Hemirhamphus sajori.

Schleg. Faun. Japon. Poiss. p. 246, pl. 110. fig. 2; *Bleek. Verh. Bat. Gen.* xxv. *Japan*, p. 116.

D. 16. A. 16–17. P. 13–14. L. lat. 95–100.

The length of the head is contained thrice and three-fifths in the total length (with the caudal), that of the snout five times and a half; upper jaw a little longer than broad. The diameter of the eye is rather less than the width of the interorbital space, and one-half of the length of the postorbital part of the head. Vertex flat. The dorsal fin commences before the anal; ventrals inserted in the anterior half of the fourth sixth of the total length. Caudal deeply emarginate. Sides with a silvery band.

Nagasaki.

11. Hemirhamphus melanurus.

Hemirhamphus melanurus, *Cuv. & Val.* xix. p. 42.

D. 15. A. 15. L. lat. 58.

The length of the entire head is contained thrice in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) five times. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the postorbital part of the head. The root of the ventral fin is midway between the base of the caudal and the eye. Dorsal and anal fins scaly; the former longer than the latter. Caudal fin deeply forked, the central rays being somewhat shorter than the eye. Back dark greenish, sides with a well-defined silvery band not quite so broad as a scale.

China; Celebes.

a. Adult. Hong Kong. Presented by J. C. Bowring, Esq.

12. Hemirhamphus sinensis.

D. 15. A. 15. L. lat. 55.

Body compressed. The length of the entire head is contained twice and two-thirds in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and a half. The triangular part of the upper jaw formed by the intermaxillaries is much broader than long. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the postorbital part of the head. The root of the ventral fin is midway between the base of the caudal and the eye; pectoral longer than the head (without snout). Dorsal and anal fins scaleless; the former rather longer than the latter. Caudal fin emarginate, the central

rays being much longer than the eye. Sides with a well-defined silvery band, which is as broad as a scale.

China.

a, *b*. Seven inches long. Presented by J. R. Reeves, Esq.

13. Hemirhamphus calabaricus.

D. 13–15. A. 14–15. L. lat. 50.

Body but slightly compressed. The length of the entire head is contained twice and three-fourths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and three-fourths. The triangular part of the upper jaw, formed by the intermaxillaries, is as broad as long. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the postorbital part of the head. The root of the ventral fin is midway between the base of the caudal and the head. Pectoral shorter than the head, without snout. Dorsal and anal fins scaleless; the former rather longer than the latter. Caudal fin emarginate, the central rays being much longer than the eye. Sides with a well-defined silvery band, which is as broad as a scale.

West Africa.

a. Six inches long. Old Calabar.

b–*c*. Four and five inches long. West Africa. Purchased of Mr. Stevens.

14. Hemirhamphus dussumierii.

Hemirhamphus erythrorinchus, var., *Lesueur*, *Journ. Acad. Nat. Sc. Philad.* ii. p. 138.

? Hemiramphus gamberur, *Rüpp. N. W. Fische*, p. 74.

Hemirhamphus dussumierii, *Cuv. & Val.* xix. p. 33; *Bleek. Verh. Bat. Genootsch.* xxiv. *Snoek.* p. 18.

D. 15. A. 14. L. lat. 52.

Body subtetrahedral. The length of the entire head is contained twice and three-fourths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) five times and a half. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. Eye large, its diameter being somewhat more than the width of the interorbital space, and not much less than the length of the postorbital part of the head. Parietal part of the head broader than long. The root of the ventral fin is midway between the head and the base of the caudal. Dorsal and anal fins nearly scaleless; the former longer than the latter. Caudal fin deeply forked, the central rays being shorter than the eye. Back dark; sides with a well-defined narrow silvery band.

Indian Ocean.

a. Adult. Mozambique. From the Berlin Museum.

b, *c*. Adult. In bad state. Zanzibar. Presented by Colonel Playfair.

d. Adult. Seychelles. From the Haslar Collection.

e. Adult. Amboyna. Purchased of Mr. Frank.

15. Hemirhamphus affinis.

D. 15. A. 16.

Closely allied to *H. dussumierii*, but with the head narrower.

Body subtetrahedral. The length of the entire head is contained twice and two-thirds in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and a half. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. Eye large, its diameter being somewhat more than the width of the interorbital space, and not much less than the postorbital part of the head. Parietal part of the head as broad as long. The root of the ventral fin is nearer to the base of the caudal than to the head. Dorsal and anal fins scaleless; the former longer than the latter. Caudal fin deeply forked, the central rays being about as long as the eye. Sides with a well-defined narrow silvery band.

South Sea.

a–b. Five and a half inches long.

16. Hemirhamphus laticeps.

D. 15. A. 15.

Closely allied to *H. dussumierii*, but with the beak longer.

Body subtetrahedral. The length of the entire head is contained twice and a half in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and two-thirds. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. Eye large, its diameter being a little more than the width of the interorbital space, and not much less than the length of the postorbital part of the head. Parietal part of the head broader than long. The root of the ventral fin is midway between the axil of the pectoral and the base of the caudal. Dorsal and anal fins scaleless; the former longer than the latter. Caudal fin deeply forked, the central rays being as long as the eye. Sides with a well-defined narrow silvery band.

Feejee Islands.

a–d. Five and a half inches long. Voyage of H.M.S. Herald.

17. Hemirhamphus quoyi.

Cuv. & Val. xix. p. 26; *Bleek. Nat. Tydschr. Nederl. Ind.* ii. p. 491, cop. in *Verh. Bat. Gen.* xxiv. *Snoek.* p. 26, and *Ned. Tydschr. Dierk.* iii. p. 153.

D. 16. A. 14. P. 12. L. lat. 50–55.

Allied to *H. dussumierii*. Body tetrahedral, as broad as deep. The length of the head is contained from three times and a half to three times and two-thirds in the total (with the caudal), that of the snout five times and a half or six times, and that of the prominent part of the lower jaw eight or eleven times. Upper jaw broader than long. The diameter of the eye is contained once and

one-third in the length of the postorbital part of the head, and equal to the width of the interorbital space. The dorsal fin commences before the anal; ventrals inserted in the fourth sixth of the total length, with the inner ray shortest; caudal fin deeply forked. Sides with a silvery band.

East-Indian archipelago; New Guinea.

a. Half-grown. From Dr. Bleeker's Collection.

18. Hemirhamphus eclancheri.

Cuv. & Val. xix. p. 51.

D. 16. A. 13.

The length of the lower jaw (beyond the extremity of the upper jaw) is one-fourth of the total (with the caudal). Head narrow above. Sides with a silvery band. (*Val.*)

Marquesas Islands.

19. Hemirhamphus russelli.

Cuv. & Val. xix. p. 32; *Cant. Mal. Fish.* p. 247 (not *Russell*).

D. 17. A. 13.

The length of the head from the intermaxillaries is one-sixth of the total (with the caudal); the length of the lower jaw, from the apex to the angle of the mouth, slightly exceeds the length of the head, varying from one-fifth to one-sixth of the distance to the point of the lower caudal lobe. The diameter of the eye is one-fourth of the length of the head. Caudal forked. The ventrals are placed opposite the posterior third of the distance between the apex of the intermaxillaries and the root of the caudal. Bluish black above, silvery on the sides above the lateral line. (*Cant.*)

Pinang; Malayan peninsula; Coromandel.

20. Hemirhamphus gernaerti.

Cuv. & Val. xix. p. 43.

D. 13. A. 15.

The length of the lower jaw (beyond the extremity of the upper jaw) is one-fifth of the total (with the caudal); the width of the interorbital space equals the diameter of the eye. Dorsal and anal small and low; caudal but little forked. The lateral silvery band is very broad. (*Val.*)

China.

Hemirhamphus occipitalis, Gill, Proc. Acad. Nat. Sc. Philad. 1859, p. 148, founded on a specimen little more than 4 inches long, may prove to be the same species: it is said to have a longer lower jaw (one-fourth of the total length); but this measurement is taken from the corner of the mouth.

21. Hemirhamphus pleii.

? Hemirhamphus balao, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. p. 136.
Hemirhamphus pleii, *Cuv. & Val.* xix. p. 21.

D. 14. A. 12–13. L. lat. 55. L. transv. 38/15.

The length of the entire head is contained twice and two-thirds in the total (without caudal), the length of the lower jaw (from the extremity of the upper jaw) four times and two-thirds. The triangular part of the upper jaw, formed by the intermaxillaries, is broader than long. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the length of the postorbital part of the head. The root of the ventral fin is conspicuously nearer to the base of the caudal than to the axil of the pectoral. Dorsal and anal fins scaly; the former much longer than the latter. Caudal fin deeply forked, the central rays being shorter than the eye. Back dark greenish, sides without well-defined silvery band.

Atlantic coasts of Tropical America.

a. Adult. St. Croix. Purchased of Mr. Stevens.
b–c. Adult and half-grown: skins. Jamaica. From Mr. Parnell's Collection.
d–e. Adult and half-grown. Dominica. Purchased of Mr. Cutter.
f–h. Half-grown and young. West Indies. Purchased of Mr. Scrivener.
i. Half-grown and young. Bahia. From Dr. O. Wucherer's Collection.

22. Hemirhamphus vittatus.

? Esox brasiliensis, *Bl.* taf. 391.
Hemirhamphus vittatus, *Valenc. in Webb & Berthel. Iles Canar. Poiss.* p. 70.

D. 13–14. A. 10–11. L. lat. 57–63.

The length of the entire head is contained twice and three-fifths in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) nearly five times. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the length of the postorbital part of the head. The root of the ventral fin is rather nearer to the base of the caudal than to the axil of the pectoral. Dorsal and anal fins scaly; the former much longer than the latter. Caudal fin deeply forked, the central rays being shorter than the eye. Back dark greenish, sides without well-defined silvery band*.

West Coast of Africa; Canary Islands.

a. Adult. Niger Expedition. From Mr. Fraser's Collection.
b. Adult. From the Haslar Collection.

* Bloch and Valenciennes mention dark cross bands, no trace of which is visible in our specimens.

23. Hemirhamphus brasiliensis.

Brown, Jamaica, p. 443, pl. 45. fig. 2.
Esox brasiliensis, *L. Syst. Nat.* i. p. 517.
Hemirhamphus brownii, *Cuv. & Val.* xix. p. 13.

B. 10. D. 12. A. 13. P. 9. V. 6. L. lat. 65.

The length of the lower jaw (beyond the extremity of the upper jaw) is one-fifth of the total (with the caudal); the diameter of the eye one-fourth of the distance between the extremity of the upper jaw and of the operculum. Dorsal and anal fins scaly; the latter shorter and lower than the former; caudal deeply forked. Sides without silvery band. (*Val.*)

West Indies; West Africa; Canary Islands.

24. Hemirhamphus marginatus.

Esox marginatus, *Forsk. Descr. Anim.* p. 67; *Rüpp. N. W. Fische*, p. 73.
? *Russell*, pl. 177.
? Hemirhamphus brevirostris, *Cuv. Règne Anim.*; *Bleek. Verhand. Batav. Genootsch.* xxiv. *Snoek.* p. 17.
Hemirhamphus lutkei, *Cuv. & Val.* xix. p. 49.
—— marginatus, *Bleek. Ned. Tydsch. Dierk.* iii. p. 148.

D. 14. A. 11–12. L. lat. 52.

The length of the entire head is contained twice and three-fifths or twice and a half in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and one-third. The triangular part of the upper jaw, formed by the intermaxillaries, is as broad as long. The diameter of the eye equals the width of the interorbital space, and is contained once and three-fourths in the length of the postorbital part of the head. The root of the ventral fin is nearer to the caudal than to the axil of the pectoral. Dorsal and anal fins scaleless; the former much longer than the latter. Caudal fin deeply forked, the central rays being shorter than the eye. Back dark greenish, sides with a rather indistinct silvery band.

Red Sea; Indian Ocean and archipelago.

a, *b*. Adult and half-grown. Amboyna. Purchased of Mr. Frank.
c. Adult. From Dr. Bleeker's Collection.

25. Hemirhamphus robustus.

D. 14. A. 11. P. 11. L. lat. 46.

Body compressed, elevated, its greatest depth being contained five times and one-half in the distance between the extremity of the upper jaw and the root of the caudal. The length of the head is contained twice and a half in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and two-thirds. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye equals the width of the interorbital space, and is two-thirds

of the length of the postorbital part of the head. Interorbital space quite flat. The root of the ventral fin is a little nearer to the caudal than to the axil of the pectoral. Dorsal and anal fins with thin scales anteriorly; the former much longer than, and commencing before, the latter. Caudal fin deeply forked, the central rays being shorter than the eye. Sides with a broad silvery band.

Van Diemen's Land.

a. Twelve inches long. Long Island. Presented by J. B. Jukes, Esq.

26. Hemirhamphus commersonii.

Valent. fig. 318; *Renard*, ii. tab. 5. fig. 2.
Acus, sp., *Willughby, Hist. Pisc.* tab. P. 8. f. 3.
Far, *Forsk. Descr. Anim.* p. 67.
Esox espadon, var., *Lacép.* v. pl. 7. f. 3.
Hemirhamphus commersonii, *Cuv. Règne Anim.*; *Cuv. & Val.* xix. p. 28; *Bleek. Verh. Bat. Genootsch.* xxiv. *Snoek.* p. 17.
—— far, *Rüpp. N. W. Fische*, p. 74.

D. 13–14. A. (11) 12. L. lat. 54. Vert. 38/16.

The length of the entire head is contained twice and two-thirds in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) four times and one-third. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye is less than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. The root of the ventral fin is equally distant from the base of the caudal and the extremity of the pectoral. Dorsal and anal fins scaly anteriorly; the former much longer than the latter. Caudal fin deeply forked, the central rays being equal in length to the diameter of the eye. Back dark greenish, sides with a silvery band and four rounded blackish blotches.

Red Sea; Indian Ocean.

a, *b*. Fine specimens. Port Natal.
c. Adult. Mozambique. Presented by Prof. Peters.
d. Adult: skin. Zanzibar. Presented by Col. Playfair.
e. Half-grown. Amboyna. Purchased of Mr. Frank.
f. Adult. From the Collection of the Zoological Society.
g. Adult. Old Collection.
h. Adult: skeleton. Port Natal.

27. Hemirhamphus fasciatus.

Bleeker, Nat. Tydschr. Ned. Ind. 1853, v. p. 89.

D. 13. A. 12. P. 10. L. lat. ca. 50.

The length of the head is contained thrice, that of the snout four times and three-fourths in the total (with the caudal); upper jaw very short, much broader than long; the diameter of the eye is more than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. Vertex flat. The dorsal fin commences before the anal, its posterior rays not shorter than the anterior;

ventrals inserted posteriorly in the fourth sixth of the total length; length of the anal about two-thirds of that of the dorsal; caudal emarginate. Body with nine or ten broad brownish cross bands; dorsal black posteriorly; central portion of the caudal black. (*Bl.*)

Sea of Solor.

a. Type of the species, 2½ inches long. Lawajong. From Dr. Bleeker's Collection.

28. Hemirhamphus limbatus.

Hemirhamphus limbatus, *Cuv. & Val.* xix. p. 44 (not synon.).
—— tridentifer, *Cant. Mal. Fish.* p. 249.

D. 13. A. 13. L. lat. 51.

The length of the entire head is contained twice and two-thirds in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) five times and a third. The triangular part of the upper jaw, formed by the intermaxillaries, is much broader than long. The diameter of the eye is nearly equal to the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. The root of the ventral fin is a little nearer to the base of the caudal than to the eye. Dorsal and anal fins scaleless; the former much longer than the latter. Caudal fin emarginate, the central rays being much longer than the eye. Sides with a well-defined silvery band nearly as broad as a scale.

Indian Ocean.

a. Seven inches long. Ceylon. Purchased of Mr. Cuming.
b–c. Five and seven inches long: skins. Pinang. Types of *H. tridentifer*, Cant.

b. *Caudal rounded.*

aa. *Dorsal rays much more numerous than anal; beak with minute teeth along each edge*: Hemirhamphodon (*Blkr.*).

29. Hemirhamphus phaiosoma.

Hemirhamphus phaiosoma, *Bleeker, Nat. Tydschr. Ned. Ind.* iii. p. 99, cop. in *Verh. Bat. Gen.* xxiv. *Snoek.* p. 26.
Hemirhamphodon phaiosoma, *Bleek. Ned. Tydschr. Dierk.* iii. p. 168.

D. 21. A. 9. L. lat. 70–80.

The length of the head is contained three times and one-fourth in the total (with the caudal), that of the snout five times and one-fourth. Upper jaw longer than broad. The diameter of the eye equals the width of the interorbital space, and is two-thirds of the length of the postorbital part of the head. The ventral fins are inserted at the anterior limit of the fourth sixth of the total length, and have the inner ray not prolonged. Caudal rounded. Entirely brown.

Rivers of Biliton.

a. Type of the species. From Dr. Bleeker's Collection.

30. Hemirhamphus pogonognathus.

Hemirhamphus pogonognathus, *Bleeker, Nat. Tydschr. Ned. Ind.* v. p. 193.
Hemirhamphodon pogonognathus, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 169.

D. 17. A. 7. P. 9. V. 6.

The length of the head is one-third of the total (with the caudal), that of the snout one-fourth; upper jaw longer than broad. Lower jaw with an apical appendage which is as long as the eye; the latter equals the width of the interorbital space or the length of the postorbital portion of the head. Vertex flat; scales smallish. The ventrals are inserted in the middle of the fourth sixth of the total length. Caudal rounded. Brownish, fins blackish. (*Bl.*)

Rivers of Banka and Biliton.

a. Type of the species, in a bad state. From Dr. Bleeker's Collection.

bb. *Number of dorsal rays not much exceeding that of anal; dorsal fin commencing before or above the origin of the anal; males with dorsal and anal rays modified; viviparous*: Zenarchopterus (*Gill*).

31. Hemirhamphus amblyurus.

Hemirhamphus amblyurus, *Bleeker, Verh. Bat. Gen.* xxiv. *Snoek.* p. 16.
—— borneensis, *Bleeker, Nat. Tydschr. Ned. Ind.* ii. p. 68, and *Verh. Bat. Gen.* xxiv. *Snoek.* p. 25.
—— bleekeri, *Kner, Sitzgsber. Akad. Wiss. Wien*, 1860, xxxix. p. 539, fig. 4 (male).
Zenarchopterus amblyurus, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 160.

D. 13. A. 10. P. 9. L. lat. 46.

Head and body strongly compressed. The length of the head is contained twice and a fifth in the total (without the caudal), that of the snout twice and three-fourths, and that of the prominent part of the lower jaw thrice; upper jaw twice as long as broad, one-fourth of the length of the prominent part of the lower. The diameter of the eye is less than the width of the interorbital space, and less than one-half of the length of the postorbital part of the head; vertex flat. The ventral fins are twice as remote from the angle of the præoperculum as from the root of the caudal. Caudal rounded; anal rays slightly dilated. Sides with a very indistinct silvery band.

East-Indian archipelago and Siam.

a. Five and a half inches long. Siam. From M. Mouhot's Collection.
b. Type of the species. From Dr. Bleeker's Collection.

32. Hemirhamphus buffonis.

? Hemirhamphus buffonis, *Cuv. & Val.* xix. p. 48.
Hemirhamphus buffonis, *Bleek. Nat. Tydschr. Ned. Ind.* iii. p. 711.
—— striga, *Blyth, Journ. As. Soc. Beng.* 1859, xxvii. p. 288.
Zenarchopterus buffonis, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 162.

D. 10–12. A. 10–12. L. lat. 42.

The length of the entire head is one-half of the total (without

caudal), the length of the lower jaw (beyond the extremity of the intermaxillaries) rather more than one-third. The triangular part of the upper jaw, formed by the intermaxillaries, is a little broader than long. The diameter of the eye is two-thirds of the width of the interorbital space, and contained once and two-thirds in the length of the postorbital portion of the head. The root of the ventral fin is much nearer to the base of the caudal than to the axil of the pectoral. Base of the dorsal longer than the head (without snout). Caudal rounded. Upper half of the dorsal black.

Fresh waters and coasts of the East-Indian archipelago.

a. Adult female. From Dr. Bleeker's Collection.

33. Hemirhamphus dispar.

Hemirhamphus dispar, *Cuv. & Val.* xix. p. 58, pl. 558; *Bleek. Nat. Tydschr. Ned. Ind.* vi. p. 498.
Zenarchopterus dispar, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 164.

D. 11. A. 11 (5+I.+I.+4). P. 8. V. 6.

The length of the entire head is contained twice and an eighth in the total (without caudal), the length of the lower jaw (beyond the extremity of the upper jaw) thrice and a half. The triangular part of the upper jaw, formed by the intermaxillaries, is as broad as long. The diameter of the eye is somewhat less than the width of the interorbital space, and contained once and two-thirds in the length of the postorbital part of the head. The root of the ventral fin is much nearer to the base of the caudal than to the axil of the pectoral. Dorsal and anal fins scaleless; the former much longer than the latter, and as long as the head (without snout). Caudal fin obtusely rounded. Sides with a well-defined silvery band half as broad as a scale; dorsal fin uniformly coloured.

East Indies.

a. Adult female. Point de Galle. Presented by Sir A. Smith.
b. Adult male, with dorsal and anal rays prolonged and thickened. From Dr. Bleeker's Collection.

34. Hemirhamphus brevirostris.

Hemirhamphus dispar, *Kner, Sitzgsber. Akad. Wiss. Wien*, 1860, xxxix. p. 537, fig. 3.

D. 10–11. A. 13. P. 9.

Scales large. The length of the head is two-fifths of the total (without caudal), that of the prominent part of the lower jaw one-fifth. Upper jaw as broad as long. The diameter of the eye is one-half of the length of the postorbital part of the head. Ventral considerably nearer to the root of the caudal than to that of the pectoral. The male has the fourth ray of the dorsal fin and the sixth of the anal prolonged and thickened; the latter, besides, being provided with additional filamentous rays. Caudal rounded. Sides with a silvery band.

East-Indian archipelago.

cc. *Anal rays more numerous than dorsal; anal commencing before dorsal fin*: Dermatogenys (*v. Hass.*).

35. Hemirhamphus fluviatilis.

Hemirhamphus fluviatilis, *Bleeker, Nat. Tydschr. Ned. Ind.* i. p. 95; cop. in *Verh. Bat. Genootsch.* xxiv. *Snoek.* p. 16; *Peters, Monatsb. Akad. Wiss. Berl.* 1865, p. 132.

Dermogenys pusillus, (*v. Hass.*) *Bleek. Ned. Tydschr. Dierk.* iii. p. 165.

D. 9–10. A. 14. P. 11. V. 6.

The length of the head is two-sevenths, that of the snout one-fifth of the total (with the caudal); upper jaw much longer than broad, one-half the length of the lower. Interorbital space concave, about as wide as the orbit. The dorsal fin commences behind the anal; ventrals inserted at the posterior limit of the third fifth of the total length. Caudal fin rounded.

Rivers of Java.

a. Two and a half inches long. From Dr. Bleeker's Collection.

36. Hemirhamphus brachynotopterus.

Bleeker, Verh. Bat. Gen. xxv. *Beng. & Hind.* p. 146.

D. 9. A. 15.

The length of the head is contained thrice and a quarter, that of the snout four times and two-thirds in the total length (with the caudal); upper jaw broader than long. The diameter of the eye is a little less than the width of the interorbital space, and about one-half of the length of the postorbital part of the head. The dorsal fin commences behind the anal; caudal convex. (*Bl.*)

River Hooghly.

37. Hemirhamphus sumatranus.

Hemirhamphus sumatranus, *Bleeker, Nat. Tydschr. Ned. Ind.* v. p. 526.
Dermogenys sumatranus, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 167.

D. 10. A. 16. P. 10. L. lat. 43.

The length of the head is contained nearly thrice, that of the snout four times and three-fourths in the total (with the caudal); upper jaw nearly twice as long as broad. The diameter of the eye is a little less than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. Ventrals inserted posteriorly in the third fifth of the total length. Caudal convex. Body without silvery band. (*Bl.*)

Rivers of Sumatra.

a. Type of the species, in bad state. From Dr. Bleeker's Collection.

B. *Pectoral elongate.*

a. *Beak very long*: Euleptorhamphus (*Gill*).

38. Hemirhamphus longirostris.

Russell, ii. p. 62, pl. 178.
Hemirhamphus longirostris, *Cuv. Règne Anim.*; *Cuv. & Val.* xix. p. 52; *Cuv. Règne Anim. Ill. Poiss.* pl. 98.

D. 22. A. 20. P. 8. V. 6.

Body slender and compressed. The length of the head, without the prominent part of the lower jaw, is one-sixth of that of the trunk, the length of the prominent part of the lower jaw one-fourth of the total. Eye one-third of the length of the head, and equal to the width of the interorbital space. Pectoral very long, with the upper ray broad and compressed, its length being contained thrice and two-thirds in that of the trunk; ventral exceedingly small. Caudal deeply forked. Sides with a silvery band. (*Val.*)

Pondicherry.

39. Hemirhamphus macrorhynchus.

Cuv. & Val. xix. p. 55, pl. 556.

D. 23. A. 22.

The length of the head, without the prominent part of the lower jaw, is one-sixth of that of the trunk, the length of the prominent part of the lower jaw one-third of the total. Eye smaller than in *H. longirostris*. The length of the pectoral is one-third of that of the trunk. Ventrals small; caudal forked. Sides with a silvery band. (*Val.*)

Long. 177° east (Paris); lat. 7° south.

B. *Beak shortened*: Oxyporhamphus (*Gill*).

40. Hemirhamphus cuspidatus.

Hemirhamphus cuspidatus, *Cuv. & Val.* xix. p. 56, pl. 557.

D. 18. A. 12.

The prominent part of the lower jaw is very short, one-thirteenth of the total length (with the caudal). Pectoral fin large, one-fourth of the total length; caudal forked, the lower lobe being twice as long as the upper. (*Val.*)

Indian Ocean.

4. ARRHAMPHUS.

Mouth formed as in *Hemirhamphus*, except that the lower jaw is not produced into a beak; both jaws with a narrow band of minute teeth. Body elongate, slender, covered with rather large scales. All the dorsal and anal rays connected by a membrane. Pectoral fin of moderate length. Gill-openings very wide.

Habitat —— ?

1. Arrhamphus sclerolepis.

D. 13. A. 15. L. lat. 43.

This is a *Hemirhamphus* in every respect, except in having the lower jaw short, as the young of that genus; however, the lower jaw projects conspicuously beyond the upper. The body is compressed, its greatest depth being contained six times and a half in the total length (without caudal); the length of the head is a little less than one-fourth of the same. The triangular part of the upper jaw, formed by the intermaxillaries, is a little broader than long. The diameter of the eye is considerably less than the width of the interorbital space, and two-thirds of the length of the postorbital part of the head. The whole of the upper surface of the head, except the intermaxillaries, is scaly. The insertion of the ventral is nearer to the extremity of the snout than to the base of the caudal. Pectoral fin two-thirds as long as the head. The dorsal commences opposite the origin of the anal; both fins are scaly at the base. Caudal fin forked, its central rays being much longer than the eye. There are seven longitudinal series of scales between the origin of the dorsal and anal; the one above the lowest is pierced by pores; a slight keel along each of the other series. Sides with a well-defined silvery band, which is half as broad as a scale.

? New Zealand.

a. Nine inches long: has been in chloride of zinc. Old Collection.
b. Six inches long. Presented by the Royal College of Surgeons.

5. EXOCŒTUS*.

Flying Fish.
Exocœtus, *Artedi, Genera*, p. 8.
—— *et* Cypsilurus, *Swainson.*

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* *Ventrals long.*

1. Exocœtus chloropterus, *Cuv. & Val.* xix. p. 109.—30° 14′ lat. S.; 44° 30′ long. W.
2. —— mesogaster, *Mitch. Trans. Lit. & Phil. Soc. New York*, i. p. 448, pl. 5. fig. 3 (not *Bloch*). Exocœtus noveboracensis, *Mitch. Amer. Month. Mag.* ii. 1817, p. 323; *Dekay, New York Faun. Fish.* p. 230, pl. 36. fig. 114 (very bad); ? *Cuv. & Val.* xix. p. 100.—Atlantic Coasts of North America.
3. —— melanurus, *Cuv. & Val.* xix. p. 101.—New York.
4. —— gibbifrons, *Cuv. & Val.* xix. p. 118.—Atlantic.
5. *Parra*, lam. 15; Exoc. mesogaster, *Cuv. & Val.* xix. p. 120, described as having a very short snout.—West Indies.
6. Exocœtus hexazona, *Bleek. Nat. Tydschr. Ned. Ind.* 1853, p. 206, and *Ned. Tydschr. Dierk.* iii. p. 118, is founded on a young example of some species, having the body banded, as is not unusual in the young of this genus.—From the Sea of Banka.
7. —— apus, *Cuv. & Val.* xix. p. 107, is also described from a young example, six inches long; snout and head short, body deep. A. 19, appears to be a misprint.—Chinese Sea.
8. —— unicolor, *C. & V.* xix. p. 97.—Vanicoro.—D. 13. A. 11. See *Bleek. Ned. Tydschr. Dierk.* iii. p. 110.
9. —— agoo, *Schleg. Faun. Japon. Poiss.* p. 247.—Japan.
10. —— polleni, *Bleek. Ned. Tydschr. Dierk.* iii. p. 130.—Atlantic.

Exoccetus, Halocypselus *et* Cypselurus, *Weinland, Proc. Bost. Soc. Nat. Hist.* vi. 1859, p. 385.

Parexoccetus, Cypselurus *et* Exoccetus, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 105.

Jaws short, intermaxillaries and maxillaries separate. Teeth minute, rudimental, and apparently sometimes absent. Body moderately oblong, covered with rather large scales. Pectorals very long, an organ of flying: all the dorsal and anal rays connected by a membrane. Gill-openings very wide. Intestinal tract simple, without pyloric appendages. Air-bladder large.

Pelagic fishes, numerous between the tropics, but extending far into the temperate zones.

Some of the fishes of this genus are provided with mandibulary barbels, which character has been thought of sufficient importance for the creation of a distinct genus, *Cypselurus*. The reasons why we hesitate to adopt this genus in the form proposed, are, first, because singularly enough these bearded Exoccœti are of small, and frequently of very small size, in fact, young individuals; secondly, because there is evidence to show that the barbels (which, besides, are of a very soft structure) are frequently mutilated, variable in form, and so often lost that one may well suspect that, in some species at least, they are peculiar to the young state only; and thirdly, because there are the same differentiations of form among the bearded Flying Fish as among the beardless ones. In both groups we find species with long and short ventrals and pectorals; in both, species with elevated dorsal fin. Therefore we prefer to use for a primary division of the species those characters which we have found to be independent of age.

I. Ventral fins shortened, not extending to the anal.

A. Pectoral fins shortened, not more than half as long as the body (without caudal).

1. Dorsal fin of moderate height.

a. Mandible with a cutaneous appendage, p. 279.

b. Barbels none, p. 280.

2. Dorsal fin elevated.

a. Mandible with a cutaneous appendage, p. 280.

b. Barbels none, p. 281.

B. Pectoral fins long, more than half as long as the body, p. 282.

II. Ventral fins of moderate length, extending to the origin of the anal, p. 284.

III. Ventral fins long, extending beyond the origin of the anal.

A. Mandible with a cutaneous appendage.

1. Pectoral fins shortened, not more than half as long as the body (without caudal), p. 284.

2. Pectoral fins long, more than half as long as the body (without caudal), p. 285.

B. Barbels none.

1. Pectoral with an oblique white band or band-like spot, p. 287.
2. Pectoral with rounded spots, p. 291.
3. Pectoral uniformly coloured, p. 293.

I. *Ventral fins shortened, not extending to the anal.*

A. *Pectoral fins shortened, not more than half as long as the body (without caudal).*

1. *Dorsal fin of moderate height.*

a. *Mandible with a cutaneous appendage.*

1. Exocœtus micropterus.

Exocœtus micropterus, *Cuv. & Val.* xix. p. 127, pl. 563; *Bleek. Act. Soc. Sc. Indo-Nederl.* i. *Amboina*, p. 63.
Cypsilurus micropterus, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 128.

D. 15. A. 14–16.

Two short barbels at the symphysis of the lower jaw. Body rounded, its height being rather more than one-sixth of the total length (without caudal): the length of the head is two-ninths of the same. Lower jaw prominent, but not produced. The length of the pectoral fin is only two-sevenths of the total (without caudal); insertion of the ventral midway between the root of the caudal and the axil of the pectoral.

Indian and Australian seas.

a. Adult. Amboyna. From Dr. Bleeker's Collection.

2. Exocœtus monocirrhus.

Exocœtus monocirrhus, *Richards. Ichth. Chin.* p. 265.

D. 13. A. 13.

A single barbel at the mandibulary symphysis, shorter than the head. The pectoral extends a little beyond the base of the caudal. The distance from the end of the snout to the ventrals, when carried backwards, does not reach to the middle of the anal. (*Rich.*)

Sea of China; two inches and a quarter long.

3. Exocœtus georgianus.

Exocœtus georgianus, *Cuv. & Val.* xix. p. 136.

D. 13. A 13.

A single barbel at the symphysis of the lower jaw, extending to the base of the pectoral. The pectoral fins extend nearly to the caudal; but the ventral is short, and inserted in the anterior third of the length of the body. Dorsal and anal fins low. The length of the head equals the height of the body, and is a little less than one-fifth of the total length. Dorsal and anal black on the posterior two-thirds. (*Val.*)

Obtained in lat. 5° S. and long. 90° E. (Paris).

Perhaps identical with *E. monocirrhus*.

b. *Barbels none.*

4. Exocœtus brevipinnis.

Cuv. & Val. xix. p. 123.

D. 12. A. 10.

The height of the body is two-thirds of the length of the head, which is two-elevenths of the total (with the caudal). The length of the pectoral is only one-half of the total (without caudal); it does not extend beyond the extremity of the ventral, which is short. Dorsal fin with the rays of nearly equal height. Pectoral uniform brownish. (*Val.*)

New Ireland.

2. *Dorsal fin elevated.*

a. *Mandible with a cutaneous appendage.*

5. Exocœtus rostratus.

D. 9. A. 10. L. lat. 40.

A single very short barbel at the symphysis of the lower jaw. The height of the body is two-elevenths of the total length (without caudal), the length of the head a little more than one-fourth. Snout much produced, its length being a little more than that of the postorbital portion of the head. Cleft of the mouth directed upwards, subvertical. The diameter of the eye is contained four times and one-third in the length of the head, and is less than the width of the interorbital space, which is flat. The depth of the head equals the distance between the extremity of the snout and the centre of the eye. There are twenty-four scales between the occiput and dorsal fin, and eight longitudinal series of scales between the origins of the dorsal and anal. The dorsal fin commences scarcely in advance of the anal; it is elevated, its anterior rays, when laid backwards, extending to the caudal. Anal fin low. The lower caudal lobe is not much shorter than the head. The pectoral fin extends to the dorsal, its length being less than one-half of the total (without caudal). The ventral extends to the vent. Dorsal black, with the last ray white; pectoral black, with the upper and lower rays white; ventral and anal whitish.

Sandwich Islands.

a. Six inches and a half long: has been in chloride of zinc. From the Haslar Collection.

6. Exocœtus brachypterus.

Exoccetus brachyopterus, *Solander, M.S.*; *Richards. Ichth. Chin.* p. 265.

D. 11. A. 14.

Two short barbels at the symphysis of the lower jaw (frequently lost*). Ventral fin of moderate length, extending nearly or quite to

* Solander says: "in spec. plurimis cirri 0."

the vent, inserted midway between snout and root of caudal. The pectoral extends somewhat beyond the origin of the dorsal. Dorsal fin very high, the longest rays reaching beyond the root of the caudal. Upper part of the dorsal black. Snout shorter than the eye. The height of the body equals the length of the head.

Otaheiti; China. (A drawing by Parkinson is in the British Museum; it is seven inches long.)

a. Two inches long. From the Haalar Collection.

b. One inch and a half long. China seas. Presented by Sir E. Belcher.

b. *Barbels none.*

7. Exocœtus mento.

Exocœtus mento, *Cuv & Val.* xix. p. 124; *Bleek. Verh. Bat. Genootsch.* xxiv. *Snoek.* p. 21.

Parexocœtus mento, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 126.

D. 11. A. 13.

The height of the body is nearly equal to the length of the head, and one-sixth of the total (with the caudal). Snout short, much shorter than the eye, the symphysis of the lower jaw being produced into a very small pointed tubercle; the origins of the dorsal and anal fins are opposite to each other; dorsal high and pointed; anal very low. The length of the pectoral is only one-half of the total (without caudal); ventrals short, scarcely extending to the anal, inserted midway between snout and root of the caudal.

Indian seas.

a. Three and a half inches long. From Dr. Bleeker's Collection.

This fish probably represents merely the more developed state of *E. brachypterus*, a species said to be frequently without barbels.

8. Exocœtus acutus.

Exocœtus acutus, *Cuv. & Val.* xix. p. 125.

D. 10. A. 11. L. lat. 41.

The height of the body is contained four times and three-fourths in the total length (without caudal), the length of the head thrice and a half. Head subtriangular, and, like the body, much compressed. Snout much produced, pointed, with the lower jaw projecting. The eye occupies the middle of the length of the head, of which it is one-fourth; it equals the width of the interorbital space, which is quite flat. The pectoral fin extends beyond the origin of the dorsal, and is one-half of the total length (without caudal). Ventral fin midway between the centre of the eye and the root of the caudal, terminating at the vent. The dorsal commences a little in advance of the anal, and is much higher than long. There are twenty-two scales between the occiput and origin of the dorsal, and nine longitudinal series of scales between the origins of the dorsal and anal fins. Pectoral uniform blackish. Ventrals whitish.

Atlantic. The above description is taken from a fine example

(6 inches long) in the Liverpool Museum; it was taken about 100 miles off Fernando Po.

B. *Pectoral fins long, more than half as long as the body.*

9. Exocœtus evolans.

Dutertre, Hist. Ant. ii. p. 212; *Rochefort, Hist. Ant.* i. p. 372; *Catesby, Carol.* tab. 8.

Exocœtus evolans, *L. Syst. Nat.* i. p. 521; *Bl.* taf. 398; *Bl. Schn.* p. 430, tab. 84; *Cuv. & Val.* xix. p. 138; *Gronov. Syst.* ed. *Gray*, p. 145; *Bleek. Cape of Good Hope*, p. 28; *Yarrell. Brit. Fish.* 3rd edit. i. p. 474.

Exocœtus, sp., *Gronov. Zoophyl.* no. 358.

Exocœtus volitans, *Lacép.* v. p. 401, pl. 12. f. 2; *Penn. Brit. Zool.* p. 441, tab. 78; *Donov. Brit. Fish.* ii. p. 31; *Brown, Philos. Trans.* lxviii. p. 790, pl. 12; *Yarrell, Brit. Fish.* 2nd edit. i. p. 453; *Benn. Whal. Voy.* ii. p. 284.

Flying Fish, *White, Voy. New South Wales*, pl. 52. fig. 2.

Exocœtus splendens, *Clarck Abel, Journ. Chin.* 1818, p. 4.

—— volans, (*Solander*) *Richards. Ichth. Chin.* p. 264.

D. 13–14. A. 13–14. L. lat. 42. Vert. 25/19.

The height of the body is two-elevenths of the total length (without caudal), the length of the head one-fourth. The depth of the head is less than the distance between the extremity of the snout and the hind margin of the præoperculum, and contained once and three-fourths in its length. Snout obtuse and short, three-fourths the length of the diameter of the eye, which is nearly one-fourth of the length of the head, and somewhat less than the width of the interorbital space, which is quite flat. The pectoral fin extends to the root of the caudal. Ventral fin midway between end of snout and of dorsal fin, terminating at a great distance from the vent. The dorsal commences a little in advance of the anal, its anterior rays not being half as long as the head. There are twenty scales between the occiput and origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral uniform blackish; with the lower border whitish. Ventrals white.

Seas of the temperate and tropical zones.

a. Adult. Mediterranean.
b. Adult. Demerara. Presented by Lieut. Friend, R.N.
c, d. Half-grown. Midway between Zanzibar and Seychelles. Presented by Lieut.-Col. Playfair.
e–f. Adult. Java. Purchased of Mr. Jamrach.
g. Adult. India. From Gen. Hardwicke's Collection.
h. Young. China Seas. Presented by Sir E. Belcher.
i. Young. North coast of Australia.
k. Adult. Presented by A. Newton, Esq.
l. Many specimens, in spirits.
m. Young.
n. Adult: skin. From Gronow's Collection.
o. Adult: skeleton. From the Haslar Collection.

10. Exocœtus obtusirostris.

This species is closely allied to *E. evolans*, but has the snout shorter, and the head more elevated.

D. 13. A. 13. L. lat. 40. Vert. 26/19.

The height of the body is one-fifth of the total length (without caudal), the length of the head one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum, and is two-thirds of its length. The upper profile of the snout descends in as oblique a line as the lower ascends; it is short, two-thirds the length of the diameter of the eye, which is two-sevenths of the length of the head, and less than the width of the interorbital space, which is quite flat. The pectoral fin extends to the root of the caudal. Ventral fin midway between end of snout and middle, or last third, of dorsal fin, terminating at a great distance from the vent. The dorsal commences opposite the origin of the anal, its anterior rays being not half as long as the head. There are twenty-four scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral uniform blackish, with a narrow whitish lower border. Ventrals white.

Tropical and subtropical seas.

a, b. Adult and half-grown. Cape de Verde Islands. Presented by the Rev. R. T. Lowe.
c. Young. New Orleans.
d. Half-grown. India. Presented by Masters, Esq.
e, f, g–i. From 7 to 9 inches long.
k. Half-grown.
l. Many young specimens*. Open sea.
m. Adult: skeleton. From the Haslar Collection.

11. Exocœtus chilensis.

Exocœtus chiliensis, *Abbot, Proc. Acad. Nat. Sc. Philad.* 1860, p. 472.

D. 16. A. 15.

Body much compressed; the diameter of the eye is contained twice and two-thirds in the length of the head, and is equal to the width of the interorbital space. The pectoral extends to the root of the caudal; ventrals very small. The anterior insertion of the *anal*† is slightly posterior to the corresponding insertion of the dorsal. (*Abbot.*)

Chili. The size of the specimens is not stated.

* It is possible that these young examples ought to be referred to *E. evolans*. If this be the case, it will be difficult to distinguish between the young of *E. evolans* and *E. obtusirostris*, both having the snout very short. If the scales are not rubbed off, the greater number of scales between the dorsal fin and lateral line in *E. obtusirostris* may be a guide towards the correct determination of the species.

† "Ventral fins" in the original, which is probably merely a slip of the pen.

II. *Ventral fins extending to the origin of the anal.*

12. Exocœtus hillianus.

? Exocœtus mesogaster, *Bloch*, xii. p. 17, tab. 399.
Exocœtus hillianus, *Gosse, Nat. Sqj. Jam.* p. 11, tab. 1. fig. 1; *Poey, Mem. Cub.* ii. p. 301.

D. 12. A. 13. L. lat. 38.

The height of the body is contained four times and two-thirds in the total length (without caudal), the length of the head four times and a quarter. The depth of the head is rather less than the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and very short, two-thirds the length of the diameter of the eye, which is one-third of the length of the head, and nearly equal to the width of the interorbital space, which is quite flat. The pectoral fin does not extend to the end of the dorsal. Ventral fins nearly midway between end of snout and root of caudal, extending to the origin of the anal. The dorsal commences a little in advance of the anal, its anterior rays being as long as the head. There are nineteen scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and that of the anal. Pectoral uniform blackish. The upper anterior half of the dorsal black; ventral fins blackish.

West Indies.

a. Five and a half inches long. West Indies. Purchased of Mr. Scrivener.

b. Four and a half inches long. West Indies. From the Collection of the Zoological Society.

III. *Ventral fins long, extending beyond the origin of the anal.*

A. *Mandible with a cutaneous appendage.*

1. *Pectoral fins shortened, not more than half as long as the body (without caudal).*

13. Exocœtus pinnatibarbatus.

Exocœtus pinnatibarbatus, *Benn. Proc. Comm. Zool. Soc.* i. p. 146.

D. 14. A. 11.

Lower jaw with a cutaneous lip, which is dilated in the middle, forming a fringed appendage. The pectoral fin extends somewhat beyond the origin of the dorsal, the ventral to the caudal; ventral midway between the extremity of the snout and the root of the caudal. Dorsal fin very high, its longest rays extending to or beyond the middle of the caudal. Body low, slender, its length being much less than the length of the head. Snout pointed, rather longer than the eye, with the lower jaw very prominent. Pectoral with three black cross bands; the greater part of the dorsal and ventrals black.

Atlantic coast of Northern Africa.

a. Two inches long. Presented by P. L. Sclater, Esq.

14. Exocœtus spilurus.

D. 11. A. 8.

A single flat barbel at the chin, half as long as the head. The pectoral fin extends to the root of the ventral, the ventral to that of the caudal. The insertion of the ventral is midway between the head and the root of the caudal. Dorsal fin moderately elevated, the last rays reaching the caudal; the height of the body is not more than the length of the head, which is short and thick. [Snout very short; eye very large; interorbital space wide, concave*.] Upper parts transparent, colourless, lower parts brown. A small black spot at the base of the barbel, and a larger one in the middle of the root of the ventral; upper part of the gill-opening black. Pectoral colourless, with a triangular black spot at the base; ventral and anal fins black.

Habitat ——?

a–b. Two and a half inches long. From the Haslar Collection.

15. Exocœtus orbignianus.

Exocœtus orbignianus, *Cuv. & Val.* xix. p. 131.

A single short and broad barbel at the symphysis of the lower jaw. The ventrals extend to the caudal, the pectorals not to the anal. Dorsal fin very high; anal very low, commencing behind the origin of the dorsal. Body slender, head short. (*Val.*)

Southern Atlantic (Montevideo). Five inches long.

2. *Pectoral fins long, more than half as long as the body (without caudal).*

16. Exocœtus solandri.

Exocœtus solandri, *Cuv. & Val.* xix. p. 129 (not synon.).

D. 11–12. A. 9.

Lower jaw with a cutaneous fringe, which, in the middle, is produced into a barbel, not quite half as long as the head. The pectoral fin extends to the end of the dorsal, and the ventral still further; insertion of the ventral nearer to the root of the caudal than to the end of the snout. Dorsal fin very high, the longest rays reaching beyond the root of the caudal. The height of the body is less than the length of the head; snout about as long as the eye. Dorsal fin black above.

Indian Ocean (Seychelles).

a. Four inches long. Presented by Dr. A. Günther.

According to our present knowledge of these fishes, *Cypselurus pulchellus*, Lowe, Proc. Zool. Soc. 1840, p. 38; or Trans. Zool. Soc. iii. p. 13, from Madeira, cannot be specifically separated from *C. solandri*. If the two fishes should prove to be identical, the name given by Lowe would have the priority.

* These characters are probably peculiar to young age only.

17. Exocœtus comatus.

Exocœtus comatus, *Mitch. Lit. & Phil. Trans. New York*, i. p. 448, pl. 5. fig. 1; *Dekay, New York Fauna. Fish.* p. 231, pl. 36. fig. 115; *Cuv. & Val.* xix. p. 133.

—— appendiculatus, *Wood, Journ. Acad. Nat. Sc. Philad.* iv. 1824, p. 283, tab. 17. fig. 2.

D. 13–14. ²A. 8.

A single very long barbel from the symphysis of the lower jaw, it extends to the ventral, and in very young examples even to the caudal. The ventral fins reach the caudal, and the pectorals nearly so; insertion of the ventral nearer to the root of the caudal than to the eye. Dorsal fin elevated, at least in young examples.

Western parts of the Atlantic.

a. Two and a half inches long. South Atlantic.

18. Exocœtus furcatus.

Exocœtus furcatus, *Mitch. Lit. & Phil. Trans. New York*, i. p. 449, pl. 5. f. 2.

? Exocœtus dussumieri, *Cuv. & Val.* xix. p. 132, pl. 564.

Exocœtus (Cypsilurus) procne, *De Fil. & Ver. Mem. Accad. Sc. Torin.* ser. 2. xviii. fig. 5.

D. 13. A. 9–10.

A pair of barbels at the symphysis of the lower jaw, which are generally as long as the head. The ventral fins extend quite, and the pectorals nearly, to the root of the caudal; insertion of the ventral nearer to the root of the caudal than to the extremity of the snout. Dorsal fin moderately high, the longest rays not reaching the caudal. The posterior part of the ventral and the lower part of the anal black. *Young* with three broad black bands across the belly, in front of the ventrals; operculum and pectorals marbled with black; the lower caudal lobe with three blackish cross bands.

Atlantic; Indian Ocean.

a. Three inches long.

b. Two and a half inches long. India. Presented by W. Masters, Esq.

19. Exocœtus nuttallii.

Exocœtus furcatus, *Cuv. & Val.* xix. p. 135 (not *Mitch.*).

—— nuttallii, *Lesueur, Journ. Ac. Nat. Sc. Philad.* ii. 1821, p. 10, pl. 4. fig. 1.

D. 15. A. 8.

A pair of barbels at the symphysis of the lower jaw (represented as trifurcate by Lesueur). The ventral and pectoral fins extend beyond the end of the anal; insertion of the ventral nearer to the root of the caudal than to the extremity of the snout. Dorsal fin high, its longest ray reaching the caudal. Pectoral fin banded; anal without black.

Atlantic coasts of America.

Lesueur represents each barbel as trifurcate; it is possible that

the barbels of the specimen examined by him were merely lacerated; and if this be the case, his fish may be identical with *E. furcatus* of Mitchell. At all events, the fish represented by Mitchell is much more similar to *E. dussumieri* than to *E. nuttallii*, with which it has been identified by Valenciennes.

B. *Barbels none.*

1. *Pectoral with an oblique white band or band-like spot.*

20. Exocœtus lineatus.

Exocœtus exiliens, *Valenc. in Webb & Berthel. Iles Canar. Poiss.* p. 71 (not *Bloch*).
Exocœtus lineatus, *Cuv. & Val.* xix. p. 92.

D. 12. A. 10–11. L. lat. 60–63. Vert. 33/18.

The height of the body is contained six times and a half in the total length (without caudal), the length of the head five times or nearly five times. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout rather produced, equal in length to the diameter of the eye, which is two-sevenths of the length of the head, and three-fourths of the width of the interorbital space, which is quite flat. The pectoral fin extends beyond the dorsal and anal, nearly to the rudimentary rays of the caudal. Ventral fins nearly midway between the head and the root of the caudal, extending beyond the middle of the base of the anal. The dorsal commences far in advance of the anal; its anterior rays are long, half as long as the head. There are from thirty-eight to forty-three scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with a narrowish oblique white band across its lower half, and with a whitish edge. Ventral white, the middle rays greyish. Frequently a series of small brownish spots along each series of scales on the lower half of the body.

Madeira.

a, *b*, *c*. Sixteen inches long.
d. Adult: skeleton. Madeira. Presented by Lady Franklin.

21. Exocœtus speculiger.

? Exocœtus speculiger, *Cuv. & Val.* xix. p. 94.
Exocœtus speculiger, *Bleek. Ned. Tydschr. Dierk.* iii. p. 122.

D. 11–12. A. 12–13. L. lat. 50. Vert. 28/17.

The height of the body is one-sixth or nearly one-seventh of the total length (without caudal), the length of the head two-ninths. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout rather produced, scarcely equal in length to the diameter of the eye, which is one-third of the length of the head, and less than the width of the interorbital space, which is slightly concave. The pectoral fin extends

beyond the dorsal and anal, nearly to the rudimentary rays of the caudal. Ventral fins nearly midway between the eye and the root of the caudal, extending to the end of the base of the anal. The dorsal commences a little behind the origin of the anal; its anterior rays are half as long as the head. There are twenty-nine scales between the occiput and the origin of the dorsal, and six or seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with an oblique white band across its lower half, and with a broad whitish edge. Ventral white, the middle rays greyish.

Indian Ocean and Australia.

a. Adult. Australia. Presented by Professor Owen.
b, *c*, *d*. Adult.
e. Adult. Amboyna. From Dr. Bleeker's Collection.
f. Adult male: skeleton.

This is most probably the same species as that named *E. speculiger* by Valenciennes, although he describes the eye as larger.

22. Exocœtus affinis.

Closely allied to *E. speculiger*, but with the snout longer and the eye shorter.

D. 11–13. A. 11–13. L. lat. 50–52.

The height of the body is nearly one-sixth of the total length (without caudal), the length of the head one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout rather produced, equal in length to the diameter of the eye, which is two-sevenths of the length of the head, and rather less than the width of the interorbital space, which is quite flat. The pectoral fin extends to scarcely beyond the dorsal and anal. Ventral fin midway between the eye and the root of the caudal, extending beyond the middle of the base of the anal. The dorsal commences opposite the anal; the length of its anterior rays is two-fifths of that of the head. There are thirty-five scales between the occiput and the origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with an oblique white blotch across its lower half, and with a narrow whitish edge. Ventrals greyish.

Atlantic.

a. Eleven inches long. Cuba? From the Collection of the Zoological Society.
b. Nine inches long. Atlantic. Purchased of Mr. Frank.
c–d. Ten inches long: not in good state. West Africa. From Mr. Raddon's Collection.

This species is perhaps identical with that named by Müller and Troschel *E. roberti* (Schomb. Hist. Barb. p. 675); but their description of it is quite insufficient for the determination of the species.

23. Exocœtus katoptron.

Exocœtus speculiger, *Bleek. Nat. Tydschr. Ned. Ind.* ix. p. 273 (not *C. & V.*).

—— katoptron, *Bleek. Ned. Tydschr. Dierk.* ii. p. 115.

D. 13. A. 11. L. lat. 46.

The height of the body is nearly one-sixth of the total length (without caudal), the length of the head one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout of moderate length, two-thirds of the diameter of the eye, which is two-sevenths of the length of the head and rather less than the width of the interorbital space, which is slightly concave. The pectoral fin extends to the end of the dorsal and anal. Ventral fin midway between centre of the eye and root of the caudal. The dorsal commences far before the anal. There are twenty-eight scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with an oblique white band.

Sumatra.

a. Type of the species, 9 inches long. From Dr. Bleeker's Collection.

24. Exocœtus robustus.

D. 14. A. 10. L. lat. 49.

The height of the body is two-elevenths of the total length (without caudal), the length of the head two-ninths. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout a little produced, scarcely equal in length to the diameter of the eye, which is two-sevenths of the length of the head and less than the width of the interorbital space, which is quite flat. The pectoral fin extends beyond the dorsal and anal, nearly to the rudimentary rays of the caudal. Ventral fins nearly midway between nostril and root of the caudal, extending beyond the middle of the base of the anal. The dorsal commences far in advance of the anal; its anterior rays are not quite half as long as the head. There are twenty-eight scales between the occiput and the origin of the dorsal, and eight longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with a broadish oblique whitish band across its anterior half, and with a whitish margin. Ventral white, the middle rays greyish.

Australia.

a. Sixteen inches long. Presented by Sir J. Richardson.

25. Exocœtus arcticeps.

D. 11. A. 8. L. lat. 49.

The height of the body is two-elevenths of the total length (without caudal), the length of the head a little less than one-fourth. The depth of the head is a little less than the distance between the extremity of the snout and the hind margin of the orbit. Snout

somewhat pointed, three-fourths of the diameter of the eye, which is a little less than one-third of the length of the head and more than the width of the interorbital space, which is flat. The pectoral fin extends scarcely to the end of the dorsal and anal. Ventral fins midway between eye and root of the caudal, extending beyond the middle of the base of the anal. The dorsal commences far in advance of the origin of the anal, its anterior rays being not quite half as long as the head. There are twenty-nine scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with a broad oblique white band across its lower half, and with a broad whitish edge. Ventral white, the middle rays greyish.

China.

a. Eight and a half inches long. China. Presented by General Hardwicke.

26. Exocœtus nigricans.

Exocœtus nigricans, *Benn. Whal. Voy.* ii. p. 287.

—— bicolor, *Cuv. & Val.* xix. p. 111; *Bleek. Ned. Tydschr. Dierk.* iii. p. 132.

—— spilopus, *Cuv. & Val.* xix. p. 118; *Gnich. in Ramon de la Sagra, Hist. Cub. Poiss.* p. 152, pl. 4. fig. 2.

D. 15. A. 9–10. L. lat. 48.

The height of the body is two-thirteenths of the total length (without caudal), the length of the head two-ninths. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout depressed, of moderate extent, nearly equal in length to the diameter of the eye, which is two-sevenths of the length of the head and considerably less than the width of the interorbital space, which is slightly concave. Lower jaw prominent. The pectoral fin extends beyond the end of the dorsal, nearly to the root of the caudal. Ventral fin midway between eye and root of the caudal, extending to the end of the anal. The dorsal commences far in advance of the origin of the anal, the length of its anterior rays being two-thirds of that of the head. There are twenty-eight scales between the occiput and the origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral black, with a broad oblique white band, which commences in the axil of the fin, and tapers on the upper rays. Ventral white, with a large black blotch on its hinder half; dorsal white anteriorly, black on its posterior two-thirds.

Atlantic, Indian, and Pacific Oceans.

a. Adult. Java. Purchased of Mr. Jamrach.

27. Exocœtus altipinnis.

Exocœtus altipennis, *Cuv. & Val.* xix. p. 109, pl. 560.

D. 13. A. 12.

The height of the body is one-eighth of the total length (with the

caudal), the length of the head one-sixth; the diameter of the eye equals the extent of the snout, and is two-sevenths of the length of the head; interorbital space flat. Pectoral and ventral fins very long. Dorsal and anal fins high, the length of the longest dorsal ray being two-thirds of that of the head. Pectoral with an oblique white band; ventral blackish, with white border. (*Val.*)

Indian Ocean.

28. Exocœtus exiliens.

Edwards, Gleanings, no. 210 (upper figure).
Exocœtus exiliens, *L. Gm.* i. p. 1400; *Cuv. & Val.* xix. p. 114.
—— fasciatus, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. p. 8, pl. 4. fig. 2.
—— exiliens, young, *Cuv. Règne Anim.*

D. 12. A. 13.

Snout very short; eyes large; interorbital space concave. Pectoral and ventral fins with broad, rather irregular, brown cross bands; the lower lobe of the caudal with dark spots; belly without cross bands.

Atlantic.

All the specimens observed are of small size; and there is no doubt that Cuvier was right in considering it the young state of some species. But it is uncertain to which species these young examples ought to be referred: probably the young of several Atlantic species are similar to one another in having a more varied coloration.

2. Pectoral with rounded spots.

29. Exocœtus pœcilopterus.

Valent. fig. 165; *Ruysch*, tab. 7. no. 18.
Exocœtus pœcilopterus, *Cuv. & Val.* xix. p. 112, pl. 561.

D. 12–13. A. 9. L. lat. 45.

Body stout, its height being two-ninths of the total length (without caudal), the length of the head one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse, somewhat pointed, three-fifths of the length of the diameter of the eye, which is nearly one-third of the length of the head and equal to the width of the interorbital space, which is slightly concave. The pectoral fin extends to the end of the dorsal. Ventral fins somewhat nearer to the eye than to the root of the caudal, extending to the end of the base of the anal. The origin of the dorsal is far in advance of that of the anal; and *the distance between the first dorsal ray and the first rudimentary caudal ray is much more than the length of the head.* Anterior dorsal rays half as long as the head. There are twenty-seven scales between the occiput and the origin of the dorsal, and eight longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with numerous rather large ovate black spots, distinctly arranged in transverse bands on the

inner side of the fin. Ventral fins white, with about three rounded blackish spots on the middle of their posterior half.

East-Indian archipelago; Formosa.

a–b. Adults. Formosa. From Consul Swinhoe's Collection.

30. Exocœtus callopterus.

D. 11–12. A. 8. L. lat. 46.

Body stout, its height being one-fifth of the total length (without caudal), the length of the head being somewhat less than one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and depressed, its length three-fifths of the diameter of the eye, which is one-third of the length of the head and less than the width of the interorbital space, which is slightly concave. The pectoral fin extends to the end of the dorsal. Ventral fins midway between præoperculum and root of the caudal, extending nearly to the end of the base of the anal. The dorsal commences far in advance of the anal, its anterior rays being half as long as the head. *The distance between the first dorsal ray and the first rudimentary caudal ray equals the length of the head.* There are thirty-four scales between the occiput and the origin of the dorsal, and nine longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral with numerous small roundish blackish-brown spots, and with the lower and upper rays whitish. Ventral white, the middle rays greyish.

Pacific coast of Panama.

a. Fine specimen, ten inches long. Pacific Coast of Panama. Presented by Capt. Dow, C.M.Z.S.

31. Exocœtus spilopterus.

? Exocœtus spilopterus, *Cuv. & Val.* xix. p. 113.
Exocœtus spilopterus, *Bleek. Ned. Tydschr. Dierk.* iii. p. 116.

D. 12–13. A. 10. L. lat. 48.

The height of the body is one-fifth or a little less than one-fifth of the total length (without caudal), the length of the head one-fourth. The diameter of the eye is more than one-third of the length of the head, nearly equal to that of the postorbital portion of the head, and not much less than the width of the interorbital space, which is slightly concave. Snout much shorter than the eye. Dorsal commencing in advance of the anal; pectorals extending to the end of the dorsal; ventrals nearly midway between the gill-opening and the base of the caudal, reaching to the middle of the anal. Pectoral violet, with scattered small brown or black spots and dots. (*Bl.*)

Celebes; ? Caroline Islands.

3. *Pectoral uniformly coloured.*

32. Exocœtus volitans.

Hirundo, *Salv.* fol. 185, pl. 67.
Exocœtus, no. 1, *Artedi, Genera*, p. 8, and *Spec.* p. 35.
Exocœtus volitans, *L. Amœn. Acad.* i. p. 320, *Syst. Nat.* i. p. 520.
Cuv. & Val. xix. p. 83, pl. 559.
? Exocœtus, *Gronov. Zoophyl.* p. 116.
Duhamel, Pêches, ii. p. 480, pl. 22. fig. 2.
Exocœtus exsiliens, *Bloch*, taf. 397.
? Exocœtus quadriremis, *Gronov. Syst.* ed. *Gray*, p. 145.

B. 11. D. 11. A. 9. P. 15. V. 6. L. lat. 63. Vert. $\frac{31}{14}$.

The height of the body is one-fifth of the total length (without caudal); upper surface of the head flat, or a little concave; snout obtuse; the lower jaw exceeds the upper a little in length. The upper caudal lobe equals the height of the body in length; but the lower is three-fifths longer. The diameter of the eye is one-third of the length of the head. Base of the ventral nearer to the extremity of the snout than to the root of the caudal. The height of the dorsal is less than the length of the head, without snout; commencement of the anal far behind that of the dorsal. Pectoral greyish-brown with a broad whitish margin; ventrals whitish.

Mediterranean.

33. Exocœtus rondeletii.

Mugil alatus, *Rondel.* ix. p. 207.
Exocœtus rondeletii, *Cuv. & Val.* xix. p. 115, pl. 562.

D. 11–12. A. 11–13.

The length of the head is not much more than the height of the body, and one-fifth of the total (without caudal); the diameter of the eye equals the extent of the snout, and is contained thrice and two-thirds in the length of the head. Dorsal fin not elevated, its longest ray being about half as long as the head; the ventral and pectoral fins extend beyond the end of the dorsal and anal; the origins of the dorsal and anal nearly opposite to each other. Pectoral brownish, with blue spots, with the lower rays white, but without white posterior border. Ventral black, with white margins. (*Val.*)

Mediterranean and neighbouring parts of the Atlantic.

34. Exocœtus bahiensis.

Exocœtus bahiensis, *Ranzani, Nov. Comm. Acad. Sc. Inst. Bonon.* v. 1842, p. 362, tab. 38.
—— vermiculatus, *Poey, Mem. Cub.* ii. p. 300.
? Exocœtus albidactylus, *Gill, Proc. Acad. Nat. Sc. Phil.* 1863, p. 167.
Exocœtus spilonotopterus, *Bleek. Ned. Tydschr. Dierk.* iii. p. 113.

D. 13. A. 9–10. L. lat. 50.

The height of the body is contained six times and a half in the total length (with the caudal), the length of the head five times and a third. The length of the snout is four-fifths of that of the eye,

which is contained three times and one-third in the length of the head. The pectorals extend to the end of the dorsal, and the ventrals to the middle of the anal. The insertion of the ventrals is midway between the end of the snout and the extremity of the upper caudal lobes. The origin of the dorsal is far in advance of that of the anal; it is of moderate height. Coloration of the pectorals uniform; dorsal with a large dark blotch.

West Indies; Coast of Brazil; East-Indian archipelago; ? Pacific coast of Central America.

a. Adult. Sumatra. From Dr. Bleeker's Collection. Type of *E. spilonotopterus*.

b. Adult. Atlantic? Purchased.

According to the description, *E. albidactylus* (Gill) would appear to differ from *E. bahiensis* in having the ventrals inserted a little more backwards.

35. Exocœtus cyanopterus.

Exocœtus cyanopterus, *Cuv. & Val.* xix. p. 97.

D. 13. A. 12.

The height of the body is a little less than one-seventh of the total length (with the caudal), the length of the head two-elevenths; the diameter of the eye is contained three times and one-third in the length of the head; interorbital space somewhat concave. Teeth longer than usual. Dorsal fin low, and nearly of equal height. Pectoral black, with the lower and hinder margins white; ventral white; dorsal with a large blackish blotch. (*Val.*).

Coast of Brazil.

36. Exocœtus rufipinnis.

Exocœtus exsiliens, *Jenyns, Zool. Beagle, Fish.* p. 122 (not *Bl.*).
Exocœtus rufipinnis, *Cuv. & Val.* xix. p. 99.

D. 10. A. 12.

The height of the body is a little less than one-eighth of the total length (with the caudal), the length of the head one-sixth. Eye smaller than in *E. cyanopterus*; interorbital space slightly concave; snout short and rather obtuse. Pectorals uniform brown, with a narrow white border. Ventrals light brown. Dorsal without black spot. (*Val.*)

Coast of Peru.

37. Exocœtus oxycephalus.

Bleeker, Nat. Tydschr. Ned. Ind. 1852, iii. p. 771, and *Nederl. Tydschr. Dierk.* iii. p. 124.

D. 10. A. 11. L. lat. 50.

The height of the body is contained five times and a third in the total length (without caudal), the length of the head four times and a third. The depth of the head equals the distance between the extremity of the snout and the hind margin of the orbit. Snout some-

what produced and pointed, but shorter than the diameter of the eye, which is contained thrice and a third in the length of the head and is equal to the width of the interorbital space, which is slightly concave. The pectoral fin extends to the end of the dorsal. Ventral fins midway between the eye and the root of the caudal, extending to the middle of the base of the anal. The dorsal commences opposite the origin of the anal, its anterior rays being rather short. There are thirty-one scales between occiput and origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral uniform blackish, with a small whitish spot near the axil. Ventral white, the middle rays greyish.

East-Indian archipelago.

a. Type of the species, 7½ inches long. From Dr. Bleeker's Collection. *b–c*. Adult. Formosa. From Consul Swinhoe's Collection.

38. Exocœtus dovii.

Exocœtus dowii, *Gill, Proc. Acad. Nat. Sc. Philad.* 1863, p. 167.

D. 12. A. 12. L. lat. 50.

The height of the body is two-elevenths of the total length (to the fork of the caudal), the length of the head a little more than one-fifth; the diameter of the eye is one-third of the length of the head. The pectoral extends to the base of the caudal; ventral inserted nearly midway between the operculum and the base of the caudal, and extending beyond the end of the anal. Pectoral fuliginous, with a light inferior border; ventral fuliginous; dorsal and anal colourless. (*Gill.*)

Pacific coast of Central America.

39. Exocœtus californicus.

Exocœtus californicus, *Cooper, Proc. Calif. Acad. Nat. Sc.* iii. 1864, p. 98, fig. 20.

D. 12. A. 10. L. lat. 58.

Body much elongate, its depth being one-eighth of the total length (to the fork of the caudal); the length of the head is almost one-fifth of the same. The diameter of the eye is less than one-third of the length of the head. The pectoral extends beyond the end of the dorsal, and the ventral to the middle of the anal. The dorsal commences in advance of the anal, and is of moderate height. Insertion of the ventral midway between root of the caudal and centre of the eye. Fins smoky. (*Cooper.*)

Catalina Island.

40. Exocœtus brachysoma.

? Exocœtus commersonii, *Lacép.* v. p. 402; *Cuv. & Val.* xix. p. 102.
? Exocœtus exiliens, *Lacép.* v. pl. 12. fig. 3 (not *Bloch*).
Exocœtus brachysoma, *Bleek. Nederl. Tydschr. Dierk.* iii. p. 111.

D. 11–13. A. 8–9. L. lat. 44.

The height of the body is nearly one-fifth of the total length (with-

out caudal), the length of the head one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and very short, scarcely more than half the length of the diameter of the eye, which is contained twice and two-thirds in the length of the head and is equal to the width of the interorbital space, which is slightly concave. The pectoral fin extends scarcely to the end of the dorsal. Ventral fins midway between centre of the eye and root of the caudal, *extending nearly to the middle of the base of the anal.* The dorsal commences far in advance of the anal, its anterior rays being half as long as the head. There are twenty-four scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral uniform blackish, with the lower rays whitish. Ventral white, the middle rays greyish.

Indian and Pacific Oceans.

a. Seven inches long.—D. 11.

b, c-d. Young. Zanzibar. Presented by Colonel Playfair.

e. Seven inches long. From Dr. Bleeker's Collection. Type of *E. brachysoma*.—D. 10.

Exocœtus simus, Cuv. & Val. xix. p. 105, from the Sandwich Islands, is perhaps identical with the species; it is described as having the length of the diameter of the eye less than the width of the interorbital space.

Exocœtus neglectus, Bleek. Ned. Tydschr. Dierk. iii. p. 112, is, if specifically distinct, most closely allied to *E. brachysoma*; it has the body a little more elongate.

a. Type of *E. neglectus*, 9 inches long. From Dr. Bleeker's Collection.—D. 11.

41. Exocœtus oligolepis.

Exocœtus unicolor, *Bleek. Verh. Bat. Gen.* xxiv. *Snoek. Visch.* p. 21 (not *Cuv. & Val.*).

—— oligolepis, *Bleek. Ned. Tydschr. Dierk.* iii. p. 109.

D. 12. A. 7–8. L. lat. 42.

The height of the body is one-fifth of the total length (without caudal), the length of the head a little less than one-fourth. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and very short, its length scarcely more than half the diameter of the eye, which is contained twice and two-thirds in the length of the head and is equal to the width of the interorbital space, which is flat. The pectoral fin extends to the end of the dorsal. Ventral fins midway between centre of the eye and root of the caudal, *extending to the end of the anal.* The dorsal commences far in advance of the anal, its anterior rays being half as long as the head. There are twenty-three scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal

and the lateral line. Pectoral uniform blackish, with the lower rays whitish. Ventrals entirely white.

East-Indian archipelago.

a. Type of the species, 8 inches long. From Dr. Bleeker's Collection.

42. Exocœtus opisthopus.

Bleek. Nederl. Tydschr. Dierk. iii. p. 121.

D. 11. A. 9. L. lat. 48.

The height of the body is one-sixth of the total length (without caudal), the length of the head two-ninths. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and very short, three-fifths of the diameter of the eye, which is one-third of the length of the head and equal to the width of the interorbital space, which is quite flat. The pectoral fin does not extend to the end of the dorsal. Ventral fins nearer to the root of the caudal than to the gill-opening, extending beyond the end of the anal. The dorsal commences far in advance of the anal, its anterior rays being half as long as the head. There are thirty scales between the occiput and the origin of the dorsal, and seven longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral uniform blackish, with the lower rays whitish. Ventral white, the middle rays greyish.

East-Indian archipelago.

a. Type of the species, 10 inches long. Celebes. From Dr. Bleeker's Collection.

b. Nine inches long. Amboyna. Purchased of Mr. Frank.

43. Exocœtus brachycephalus.

D. 12. A. 13. L. lat. 50.

The height of the body is two-thirteenths of the total length (without caudal), the length of the head one-fifth. The depth of the head is somewhat less than the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and short, three-fourths of the diameter of the eye, which is two-sevenths of the length of the head and two-thirds of the width of the interorbital space, which is somewhat concave. The pectoral fin extends to the root of the caudal. Ventral fin midway between præoperculum and root of the caudal, extending to the end of the anal. The dorsal commences above the origin of the anal, its anterior rays being more than half as long as the head. There are twenty-nine scales between the occiput and the origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral and ventral fins black.

China.

a. Thirteen inches long. China. Presented by Sir J. Richardson.

44. Exocœtus nigripinnis.

Cuv. & Val. xix. p. 108; *Cant. Mal. Fish.* p. 250; *Bleek. Act. Soc. Sc. Indo-Nederl.* ii. *Amboina* viii. p. 86; and *Ned. Tydschr. Dierk.* iii. p. 120.

D. 10–11. A. 10–12. L. lat. 48–50.

The height of the body is one-sixth or a little less than one-sixth of the total length (without caudal), the length of the head two-ninths. The depth of the head equals the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and very short, scarcely more than half the length of the diameter of the eye, which is two-fifths of the length of the head and is less than the width of the interorbital space, which is concave. The pectoral fin extends to the end of the dorsal or to the root of the caudal. Ventral fin midway between eye and root of the caudal, extending nearly to the end of the tail. The dorsal commences above the origin of the anal, its anterior rays being more than half as long as the head. There are twenty-nine scales between the occiput and the origin of the dorsal, and six longitudinal series of scales between the origin of the dorsal and the lateral line. Pectoral and ventral fins black.

Indian and Australian seas.

a. Two and a half inches long. Pinang. From Dr. Cantor's Collection.

b. Two and a half inches long: skin. Pinang. From Dr. Cantor's Collection.

c. Three and a half inches long. Swan River.

d. Three inches long. Purchased of Mr. Stevens.

All the specimens which have been named *E. nigripinnis* by various authors are small; the largest I have seen is five inches long. It is not improbable that they are merely the young of some other species.

Fam. 15. CYPRINODONTIDÆ.

Cyprinodontes, *Agassiz, Poiss. Foss.* v. 2. p. 47; *Müller, Abhandl. Akad. Wiss. Berl.* 1846, p. 183.

Head and body covered with scales; barbels none. Margin of the upper jaw formed by the intermaxillaries only. Teeth in both jaws; upper and lower pharyngeals with cardiform teeth. Adipose fin none; dorsal fin situated on the hinder half of the body. Stomach without blind sac; pyloric appendages none. Pseudobranchiæ none; air-bladder simple, without ossicula auditus.

Sexes frequently differentiated. Mostly viviparous.

Freshwater fish of Southern Europe, Africa, Asia, and America.

Synopsis of the Genera.

I. **The bones of each mandibulary are firmly united; intestinal tract short or but little convoluted** (CYPRINODONTIDÆ CARNIVORÆ).

A. Anal fin of the male not modified into an intromittent organ.

1. *Teeth incisor-like, notched* (CYPRINODONTINA).

a. *Ventral fins present.*

Teeth in a single series ..... 1. CYPRINODON, p. 301.

Teeth in several series, all the teeth being tricuspid. 2. FITZROYIA, p. 307.

A band of villiform teeth behind the series of incisors. 3. CHARACODON, p. 308.

b. *Ventral fins none.*

Teeth in a single series ..... 4. TELLIA, p. 308.

2. *All the teeth pointed* (FUNDULINA).

a. *Ventral fins present.*

Teeth in a single series; dorsal and anal fins many-rayed. 5. LIMNURGUS, p. 309.

Teeth in a single series; number of fin-rays not increased. 6. LUCANIA, p. 309.

Teeth in narrow bands; dorsal fin short, commencing behind the anal, which is more or less elongate. Air-bladder present ..... 7. HAPLOCHILUS, p. 310.

Teeth in bands; dorsal fin commencing before, or opposite, the origin of the anal ..... 8. FUNDULUS, p. 318.

Teeth in bands; dorsal fin short, commencing behind the anal. Air-bladder none ..... 9. RIVULUS, p. 327.

b. *Ventral fins none.*

Teeth in bands ..... 10. ORESTIAS, p. 328.

B. Sexes differentiated, the anal fin of the male being modified into an intromittent organ*.

1. *Teeth incisor-like, notched* (JENYNSIINA).

Origin of the anal fin behind that of the dorsal 11. JENYNSIA, p. 331.

2. *All the teeth pointed* (ANABLEPINA).

a. *Dorsal fin long, and many-rayed.*

Teeth in bands ..... 12. PSEUDOXIPHOPHORUS, p. 332.

b. *Dorsal fin short; eye normal.*

Snout produced ..... 13. BELONESOX, p. 333.

Snout not produced ..... 14. GAMBUSIA, p. 333.

c. *Eye divided into an upper and lower portion.*

Supraorbital arches much raised ..... 15. ANABLEPS, p. 337.

II. The bones of each mandibulary are not united, the dentary being moveable. Intestinal tract with numerous convolutions. Sexes differentiated (CYPRINODONTIDÆ LIMNOPHAGÆ).

1. *Teeth pointed, in bands.*

Dorsal fin with not more than eleven rays ... 16. POECILIA, p. 339.

Dorsal fin with twelve or more rays ..... 17. MOLLIENESIA, p. 347.

2. *Teeth pointed, in a single series.*

Origin of the anal behind that of the dorsal... 18. PLATYPOECILUS, p. 350.

Origin of the anal in advance of, rarely opposite to, that of the dorsal. 19. GIRARDINUS, p. 351.

Appendix ..... 20. LEBISTES, p. 355.

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* We conclude, from the form and structure of this more or less sword-shaped organ, that it is really (partially at least) introduced into the vulva of the female; but it is uncertain whether it serves to conduct the milt or merely to give the male a firmer hold of the female during the copulation.

First Group. CYPRINODONTIDÆ CARNIVORÆ.

The bones of each mandibulary are firmly united; intestinal tract short or but little convoluted. Carnivorous or insectivorous.

1. CYPRINODON*.

Cyprinodon, *Lacép.* v. p. 486.
Lebias, *Cuv. Règne Anim.*
Aphanius, *Nardo, Prodr. Adriat. Ichthyol.* pp. 17, 23.
Micromugil, *Gulia, Tentamen Ichthyol. Melit.* p. 11.

Cleft of the mouth small, developed laterally and horizontally; mandible short, with the bones of each side firmly united. Snout short. Teeth of moderate size, notched, in a single series. Scales rather large. Origin of the anal fin behind that of the dorsal in both sexes, both fins being larger in the male than in the female. Intestinal tract but slightly convoluted.

Fresh waters of the Mediterranean region; North America.

The species may be arranged geographically thus:—

a. Species of the Old World, p. 302.
β. Species of the New World, p. 305.

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* 1. Cyprinodon elegans, *Baird & Girard, in Proc. Acad. Nat. Sc. Philad.* 1853, p. 389, and in *U. S. & Mex. Bound. Ichthyol.* p. 66, pl. 37. figs. 1–7.—Rio Grande del Norte.

2. —— gibbosus, *Baird & Girard, in Proc. Acad. Nat. Sc. Philad.* 1853, p. 390, and in *U. S. & Mex. Bound. Ichthyol.* p. 67, pl. 38. figs. 1–7.—Texas.

3. —— macularius, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 389, and in *U. S. & Mex. Bound. Ichthyol.* p. 68, pl. 37. figs. 8–11.—Rio San Pedro.

4. —— californiensis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 157.—San Diego.

5. —— eximius, *Girard, l. c.* p. 158.—Chihua-hua River.

6. Aphanius fasciatus, *Nardo, Prodr. Adriat. Ichth.* pp. 17 & 23, or *Isis*, 1827, p. 438; and *Boërio, Dizion. Dialetto Venez.* 1829, p. 438.—Brackish water near Venice. D. 12. A. 12.

7. Micromugil timidus, *Gulia, Tent. Ichthyol. Melit.* p. 11: "Dorso plumbeo, abdomine argenteo lucido, fasciis obscuris longitudinalibus ornato."—Malta. Vernacular name: Buzak.

8. —— macrogaster, *Gulia, l. c.*: "Corpore platineo, pinnis omnibus flavescentibus."—Malta.

9. Trifarcius riverendi, *Poey, Mem. Cub.* ii. p. 306.—Cuba.

10. Adinia multifasciata, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 117; and in *U. S. & Mex. Bound. Ichth.* pl. 38. figs. 12–14 (as *Limia pecilioides*, fem.) from Texas.—The characters assigned to the genus *Adinia* are quite insufficient to distinguish it from *Cyprinodon* or *Fundulus*; so that, until the typical specimens are reexamined, it must remain uncertain whether this fish ought to be referred to one of the genera named, or whether it is really the type of a distinct genus.

a. Species of the Old World.

1. Cyprinodon calaritanus.

Alpismaris risso, A. marmoratus, *Risso, Eur. Mérid.* iii. p. 458.
Lebias calaritana, *Bonelli*; *Canestr. Arch. Zool. Anat. Fisiol.* iv. p. 127.
Lebias flava, *Costa, Faun. Napol.* p. 35, pl. 17. figs. 1 & 2.
Aphanius nonus, *Nardo, Prodr. Adriat. Ichth.* pp. 17, 23.
Cyprinodon calaritanus, *Cuv. & Val.* xviii. p. 151; *Bellotti, Mem. Accad. Sc. Torin.* 1858, xvii. p. clix (not synon.).
—— moseas, *Cuv. & Val.* xviii. p. 168, pl. 528.
—— hammonis, *Cuv. & Val.* xviii. p. 169; *Martens, Wiegm. Arch.* xxiv. p. 155, taf. 4. fig. 5.
—— cyanogaster, *Guichen. Rev. & Mag. Zool.* 1859, p. 378 (female).
—— doliatus, *Guichen. l. c.* p. 379 (male).
—— dispar, *Günth. Proc. Zool. Soc.* 1859, p. 470.

D. 9–10. A. 10–11. V. 6. L. lat. 26. L. transv. 9–10. Vert. 13/15.

The height of the body is somewhat less than one-third of the total length (without caudal), the length of the head rather more than one-fourth; head thick, snout obtuse. The diameter of the eye equals the length of the snout, is rather more than one-half of the width of the interorbital space, and contained thrice and two-thirds in the length of the head. Dorsal and anal elevated in males, and extending to the caudal, if laid backwards. In males the origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the eleventh scale of the lateral line; in females the dorsal is situated further backwards, its origin being midway between the gill-opening and the root of the caudal, but also corresponding to the eleventh scale of the lateral line. The first anal ray is below the fifth of the dorsal. Caudal truncated. Mandible about as long as eye. Light-greenish olive.

Males with nine or ten very distinct silvery cross bars, each about as broad as a scale; anterior dorsal rays black; caudal with a rather indistinct blackish band across its hinder half.

Females silvery on the side, with more or less numerous narrow black vertical stripes, which do not extend on to the back or to the belly.

In the *young* the silvery cross bars and black vertical stripes are as frequently present as absent.

Brackish or saline waters of Southern Europe and North Africa.

a–b. Males, 2 inches long. Susa (Tunis). From Mr. Fraser's Collection.
c–e. Females, 2 to 3 inches long. Susa (Tunis). From Mr. Fraser's Collection.
f–g. Half-grown. Hot springs of Sidi Ohkbar, Sahara. Presented by the Rev. H. B. Tristram.
h–i. Half-grown. South Europe. Presented by — Miller, Esq.

Cyprinodon iberus, Cuv. & Val. xviii. p. 160, pl. 528 (male); *Lebias ibericus*, Steindachner, Sitzgsber. Akad. Wiss. Wien, lii. 1865,

p. , figs. 1–3, appears scarcely to differ from *C. calaritanus*. It is said to have ten, rarely nine anal rays; and the number of cross bands in the male is from twelve to sixteen.

2. Cyprinodon fasciatus.

Lebias fasciata, *Valenc. in Humb. Observ. Zoolog.* ii. p. 160, pl. 51. fig. 4 (bad).

Cyprinodon fasciatus, *Cuv. & Val.* xviii. p. 158; *Martens, Wiegm. Arch.* xxiv. p. 153, taf. 4. fig. 4.

D. 10. A. 8 (9). V. 7. L. lat. 26.

Known from males only.

The height of the body is nearly equal to the length of the head, which is one-fourth of the total (with the caudal). The first dorsal ray is in the first half of the total length; dorsal and anal fins elevated. Sides of the body with ten or twelve silvery cross bands; dorsal with the anterior margin black; caudal sometimes with a greyish cross band.

Brackish waters of Sardinia and Venice.

a. Two and one-third inches long. Sardinia.

Bellotti, who observed the difference of coloration between the two sexes of *C. calaritanus* (as described above), thought that *C. fasciatus* (Val.) was the male of *C. calaritanus*. Mem. Accad. Sc. Torin. 1858, xvii. p. clix. However, as Valenciennes asserts that he has verified the small number of anal rays in several specimens of *C. fasciatus*, it is probable that they are really two distinct species, in which the sexes are similarly distinguished from each other, but that Valenciennes knew the female only of *C. calaritanus*, and the male only of *C. fasciatus*.

Also the specimens collected by Martens at Venice had eight anal rays.

3. Cyprinodon dispar.

Lebias dispar, *Rüppell, Atl. Fische*, p. 66, taf. 18. fig. 1 (male); (fig. 2, female?).

—— velifer *et* lunatus, *Ehrenberg, MS.*

Cyprinodon lunatus, *Cuv. & Val.* xviii. p. 161.

—— hammonis, *Richards. Proc. Zool. Soc.* 1856, p. 371 (not *Cuv. & Val.*).

D. 9. A. 10. V. 7. L. lat. 25–27. L. transv. 9.

The height of the body equals the length of the head, and is contained thrice and two-thirds in the total (without caudal); head thick, snout obtuse. The diameter of the eye equals the length of the snout, is rather more than one-half of the width of the interorbital space, and contained thrice and two-thirds in the length of the head. Dorsal and anal elevated in males, and extending to the caudal if laid backwards. In males the origin of the dorsal fin is midway between the root of the caudal and the præoperculum, and corresponds to the eleventh scale of the lateral line; *in females* the dorsal is situated further backwards, its origin being midway between the gill-opening and the root of the caudal, but also cor-

responding to the eleventh scale of the lateral line. The first anal ray is below the sixth of the dorsal. Caudal truncated. Mandible about as long as the eye. Caudal fin with two crescent-shaped brown cross-bands. Body without silvery cross bars; with irregularly reticulated markings in the young.

North Africa.

a, b, c. Adult males. Abyssinia. From Dr. E. Rüppell's Collection.
d. Female.
e. Half-grown male.
f–g, h–l. Young. Brine-spring, temp. 91°, near Usdum, Dead Sea. From the Collection of H. Poole, Esq.
m. Many young specimens. Dead Sea. From the Collection of the Rev. H. B. Tristram.

4. Cyprinodon cypris.

Lebias cypris, *Heckel, in Russegger, Reise,* i. p. 1090, ii. 3. p. 242, taf. 19. fig. 1.

D. 11–12. A. 10. V. 5. L. lat. 26. L. transv. 8.

Body rather elevated and compressed, its height being somewhat more than the length of the head, which is contained thrice and a quarter in the total (without caudal). The diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and nearly equal to the width of the interorbital space. Dorsal and anal fins not extending to the caudal when laid backwards; the dorsal fin commences halfway between the extremity of the snout and the root of the caudal, immediately behind the insertion of the ventrals. The anal commences somewhat before the termination of the dorsal. Greenish olive above, silvery on the sides.

Male with the fins blackish, the vertical fins with series of black dots.

Female lighter, generally with brownish dots on the tail; fins whitish, immaculate.

Syria, Bagdad.

a. Many specimens, not in good state. Jordan. From the Collection of the Rev. H. B. Tristram.

5. Cyprinodon sophiæ.

Lebias sophiæ, *Heckel, in Russegger, Reise,* ii. 3. p. 267, taf. 22. fig. 2.

D. 11–12. A. 10–12. V. 6. L. lat. 26. L. transv. 7.

The height of the body is contained thrice and a half in the total length (without caudal), the length of the head thrice and a third. Snout very obtuse, subtruncated, the mandible being directed vertically upwards. The diameter of the eye is more than the length of the snout, one-third of that of the head, and not much less than the width of the interorbital space. Dorsal and anal of moderate size, somewhat higher in males than in females. In males as well as in females the origin of the dorsal is midway between the root of the caudal and the eye, and corresponds to the eleventh scale of the lateral line; it is immediately behind the vertical from the root of

the ventral fins, which is conspicuously nearer to the extremity of the snout than to the base of the caudal. The first anal ray is below the fourth of the dorsal. Mandible about as long as the eye.

Male dark greenish brown, with silvery dots on the caudal portion of the trunk; fins black, dorsal and anal with two oblique series of white spots.

Female and *young* light brownish green, with numerous silvery vertical streaks. Fins transparent, colourless.

Persia, Syria.

a. Many specimens, $\frac{1}{2}$–$1\frac{1}{4}$ inch long. Ain Feshkhah. Dead Sea. From the Collection of the Rev. H. B. Tristram.

6. Cyprinodon punctatus.

Lebias punctatus, *Heckel, in Russegger, Reise*, ii. 3. p. 268, taf. 22. fig. 3.

D. 11. A. 10. L. lat. 27. L. transv. 3/4.

Very closely allied to *C. sophiæ*, from which it differs in the coloration. Silvery, with numerous brown spots disposed in irregular longitudinal series; a brownish band from the eye to the upper end of the gill-opening; fins uniform yellowish. Females with the spots paler. (*Heck.*)

Nemek-Deria, a saltwater lake near Schiraz.

Lebias crystallodon, Heckel, in Russegger, Reise, ii. 3. p. 269, taf. 22. fig. 4, from the same locality, is perhaps merely an old female, after spawning, of the preceding species.

7. Cyprinodon mento.

Lebias mento, *Heckel, in Russegger, Reise*, i. p. 1089, taf. 6. fig. 4.
Cyprinodon mento, *Cuv. & Val.* xviii. p. 171.

D. 12. A. 11. V. 6. L. lat. 27. L. transv. 3/4.

The height of the body equals the length of the head, which is two-sevenths of the total (without caudal); the diameter of the eye is one-fourth of the length of the head, and one-half of the width of the interorbital space. Ventral fins scarcely in advance of the middle of the total length (the caudal not included), but conspicuously in advance of the dorsal. The anal fin commences below the middle of the dorsal, with the hinder third of the total length (without caudal). Dorsal and anal fins not elevated. Male dark brown, with the fins black- and white-dotted. Female lighter, with uniform whitish fins. (*Heckel.*)

Mosul.

β. Species of the New World.

8. Cyprinodon variegatus.

Cyprinodon variegatus, *Lacép.* v. pp. 486, 487, pl. 15. fig. 1; *Valenc. in Humb. Obs. Zool.* ii. p. 165; *Cuv. & Val.* xviii. p. 173.
Esox ovinus, *Mitch. Trans. Lit. & Phil. Soc. New York*, 1815, i. p. 441, pl. 4. fig. 7.

Lebias ellipsoidea, *Lesueur, Journ. Acad. Nat. Sc. Philad.* ii. 1821, p. 6, pl. 2.
—— rhomboidalis, *Valenc. in Humb. Obs. Zool.* ii. p. 160.
Cyprinodon ovinus, *Valenc. in Humb. Obs. Zool.* ii. p. 164.
Lebias ovinus, *Dekay, Nat. Hist. New York, Fish.* p. 215, pl. 17. fig. 84.

D. 10–11. A. 10–11. V. 7. L. lat. 25. L. transv. 12–13.

The height of the body is contained from twice and one-eighth to twice and one-third in the total length (without caudal), the length of the head thrice and one-fourth. The humeral scale (behind the gill-opening) is three or four times as large as the others. Snout very obtuse, the mandible being directed obliquely upwards. The diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and less than the width of the interorbital space. Dorsal and anal of moderate size, very much higher in males than in females and young males, but they extend only to the middle of the tail when laid backwards. The origin of the dorsal is midway between the root of the caudal and the end of the snout in females, but more advanced in males; in both it corresponds to the eighth scale of the lateral line, and is conspicuously in advance of the vertical from the root of the ventral fins. The first anal ray is below the end of the dorsal. Mandible about as long as the eye.

Male without black spots on the body; caudal and sometimes the other fins black-edged.

Females with irregular blackish or black vertical spots on the body; fins without black margin; a black stripe across the root of the caudal.

United States.

a–b. Males, 2 and 2½ inches long. North America. From Mr. Parnell's Collection.
c–e. Females, 2 and 2½ inches long. North America. From Mr. Parnell's Collection.
f–g. Females, 1 and 1½ inches long. North America. From Mr. Parnell's Collection.
h–m. Females, 1½ inches long. From the Haslar Collection.

9. Cyprinodon carpio.

D. 11–12. A. 10. V. 7. L. lat. 25. L. transv. 10.

The height of the body is contained from twice and two-fifths to twice and three-fifths in the total length (without caudal), the length of the head thrice. The humeral scale (behind the gill-opening) is scarcely larger than the others. Snout rather obtuse, the mandible being directed obliquely upwards. The diameter of the eye is a little less than the length of the snout, two-sevenths of that of the head, and less than the width of the interorbital space. Dorsal and anal of moderate size. The origin of the dorsal is somewhat nearer to the root of the caudal, than to the end of the snout (in females), and corresponds to the ninth scale of the lateral line; it is distinctly behind the vertical from the root of the ventral fins. The first anal

ray is below the end of the dorsal. Mandible about as long as the eye. Uniform greenish-olive (in specimens preserved in spirits), shining silvery towards the belly. A silvery band runs along the lower edge of the præorbital and the lower margin of the orbit, to the upper end of the gill-opening.

America.

a–e. Females, from 2 to 5 inches long. From the Collection of Haslar Hospital.

10. Cyprinodon parvus.

Baird & Girard, Ninth Smithson. Report, 1855, p. 345.

D. 10. A. 10. V. 6. L. transv. 8.

Form elongated; head less than one-fourth of the total length (with the caudal); eye one-third of the length of the head. Coloration plain. (*Baird.*)

Very small. Long Island.

11. Cyprinodon bovinus.

Baird & Girard, Proc. Acad. Nat. Sc. Philad. 1853, p. 389, and in *U. S. & Mex. Bound. Ichthyol.* p. 67, pl. 37. figs. 12–18.

D. 9. A. 8.

The height of the body is contained from twice and one-sixth to twice and one-half in the total length (without caudal), the length of the head thrice. The diameter of the eye is one-fourth of the length of the head. Sexual differences as in *C. variegatus*. The origin of the dorsal fin is midway between the extremity of the snout and the root of the caudal, rather behind, than in advance of, the vertical from the root of the ventral. Colours as in *C. variegatus*. (*B. & G.*)

Texas.

2. FITZROYIA.

Lebias, sp., *Jenyns.*

In the present state of our knowledge, this genus would appear to differ from *Cyprinodon* in having the tricuspid teeth arranged in several series.

I name it in memory of the late Admiral Fitzroy, the commander of the expedition during which this fish was discovered.

Montevideo.

1. Fitzroyia multidentata.

Lebias multidentata, *Jenyns, Voy. Beagle, Fish.* p. 117, pl. 22. fig. 3.

D. 9. A. 9. V. 6. L. lat. 32. L. transv. 8.

The height of the body is more than the length of the head, which is one-fifth of the entire length; jaws nearly equal, the upper one very protractile. There is, behind the front row of tricuspid teeth, a band of smaller teeth above and below, all of which

are also tricuspid. The origin of the dorsal fin corresponds exactly to the middle of the total length, and is somewhat in advance of that of the anal. All the fins small. Greenish-brown (in a preserved state), with some indistinct light bands along the sides. (*Jen.*)

Montevideo.

3. CHARACODON.

Cleft of the mouth small, developed laterally and horizontally; mandible short, with the bones of each side firmly united. Snout short. Teeth rather small, bicuspid, in a single series; but there is a narrow band of villiform teeth behind the series of incisors. Scales of moderate size. Origin of the anal fin opposite, or nearly opposite, to that of the dorsal. Anal rays more numerous in the male than in the female. Intestinal tract but slightly convoluted.

Central America.

1. Characodon lateralis.

D. 10–11. A. 13 in fem., 15–16 in male. L. lat. 35. L. transv. 12.

In general habits very similar to a Cyprinodon. Body rather elevated, with the neck somewhat arched, its greatest depth being rather more than the length of the head, and one-third of the total (without caudal). Head thick and broad, with the snout obtuse, as long as the diameter of the eye, which is one-fourth of the length of the head. The mandible ascends obliquely, and is longer than the eye. There are about twenty smallish teeth in each jaw; their apex is indistinctly notched. Interorbital space flat, its width being two-fifths of the length of the head. The origin of the dorsal fin is a little nearer to the end of the caudal than to the occiput, and a little behind that of the anal. Both fins are small and rounded. In the male the six anterior rays are of nearly equal length, but considerably shorter than the following, forming a very distinct portion of the fin; all these rays are very closely set. Caudal fin small, truncate or slightly convex. The distance between dorsal and caudal is somewhat more than the least depth of the tail, and equal to the distance between eye and gill-opening. Pectoral obtuse, not quite reaching the ventral. Ventral small, not quite extending to the vent. Brownish olive (in spirits), with a darker band running from the eye to the root of the caudal: this band is sometimes broken up into a more or less regular series of brownish black spots.

Central America.

a–d. Females, 2½ inches long. From Dr. B. Seemann's Collection.
e–i. Females and two males, 1⅞ inch long. From the Haslar Collection.

4. TELLIA.

Tellia, *Gervais, Ann. Sc. Nat.* 1853, xix. p. 15.

Very similar to *Cyprinodon*, but without ventral fins. The

lower jaw projecting beyond the upper; teeth tricuspid, in a single series in both jaws.

Alpine pools of the Atlas.

1. Tellia apoda.

Gervais, l. c.; Valenc. in Compt. Rend. 1858, xlvi. p. 715.

D. 15. A. 13.

The dorsal fin commences a little before the posterior third of the length of the body.

River Tell.

5. LIMNURGUS.

Girardinichthys*, *Bleek. Cyprin.* p. 481.

Cleft of the mouth directed upwards, rather narrow, upper jaw very protractile; bones of the mandible firmly united; both jaws with a series of small subcylindrical teeth. Scales rather small. Dorsal and anal fins many-rayed, but not very long; anal below the dorsal; sexes not differentiated by modification of the anal fin. Intestinal tract about as long as the fish. The gill membranes of both sides are partially united, and not attached to the isthmus.

Mexico.

1. Limnurgus variegatus.

Lucania, sp., *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 118.
Girardinichthys innominatus (!)*, *Bleek. l. c.* p. 484.

D. 20–21. A. 22–23. V. 6. L. lat. 44.

The height of the body is more than the length of the head, which is scarcely one-fourth of the total length (without caudal). The neck is arched, the upper profile of the head being concave. Head thick, with the snout obtuse, the mandible being vertically directed upwards. The diameter of the eye is one-half of the width of the interorbital space, which is two-fifths of the length of the head. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and, in females, conspicuously in front of that of the anal. Brownish olive, with irregular dark-brown cross bands, which are sometimes confluent.

Vicinity of the city of Mexico.

a. Many adult female specimens, 2½ inches long. Old Collection.

6. LUCANIA†.

Lucania, sp., *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 118.

Cleft of the mouth small; bones of the mandible firmly united; snout not produced, the lower jaw more or less prominent; both jaws with a single series of conical teeth. Scales rather large. Rays

* This barbarous name has been proposed by Bleeker, who never saw the species.

† 1. Lucania affinis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 118.—Matamoras.

of the dorsal and anal fins in moderate number. Origin of the dorsal fin in advance of that of the anal. Sexes not differentiated by modification of the anal fin. Intestinal tract?

Southern parts of North America and Central America.

For the knowledge of this genus and its species we depend entirely on the accounts given by Girard, which are not only most incomplete, but which prove so frequently to be incorrect: one thing appears to be certain, that he has united in it species which can hardly be kept together in the same natural genus.

1. Lucania venusta.

Limia venusta, *Girard, U. S. & Mex. Bound. Ichthyol.* p. 71, pl. 39. figs. 20–23.

Lucania venusta, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 118.

D. 13. A. 11. V. 6.

The height of the body is about equal to the length of the head, and two-sevenths of the total (without caudal). The origin of the dorsal is midway between the extremity of the snout and the base of the caudal. Origin of the anal opposite the middle of the dorsal. Reddish brown; fins immaculate. (*Girard.*)

Texas.

7. HAPLOCHILUS*.

Aplocheilus, *McClell. Ind. Cypr. As. Res.* xix. pp. 301, 426.
Panchax, *Cuv. & Val.* xviii. p. 380.
Zygonectes, *Agassiz, in Sillim. Amer. Journ.* 1854, xvii. p. 353.
Micristius, *Gill, Canad. Nat. & Geol.* 1865, August.

Snout flat, both jaws being much depressed. Bones of the mandible firmly united; upper jaw protractile; both jaws with a narrow band of villiform teeth†. Body oblong, depressed anteriorly, compressed posteriorly. Dorsal fin short, commencing behind the origin of the anal, which is more or less elongate. Intestinal tract but slightly convoluted; air-bladder present.

East Indies; tropical Africa; temperate and tropical America.

The species may be geographically arranged:

α. Indian species, p. 311.
β. African species, p. 312.
γ. American species, p. 314.

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* 1. Aplocheilus melastigmus, *McClell. Ind. Cyprin.* pp. 301, 427.—Calcutta.—D. 7. A. 22.

2. Aplocheilus, sp., *McClell. l. c.* pl. 55. fig. 4; A. macclellandii, *Bleek. Cypr.* p. 487 (name only).—Bengal.

3. Fundulus cingulatus, *C. & V.* xviii. p. 197.—United States.—D. 8. A. 10. Panchax pictum, *C. & V.*, has proved to be identical with *Betta trifasciata*; see Bleeker, Cyprin. p. 489.

† The vomerine teeth of *Panchax* are minute and rudimental, not offering a character on which a genus may be founded. In one out of three specimens, they are entirely absent.

a. Indian species.

1. Haplochilus panchax.

Esox panchax, *Buch. Ham. Fish. Gang.* pp. 211, 380, pl. 3. fig. 69.
Aplocheilus chrysostigmus, *McClell. As. Res.* xix. 2. pp. 301, 426, pl. 42. fig. 2.
—— panchax, *McClell. l. c.* p. 302.
Panchax lineatum, *Cuv. & Val.* xviii. p. 381.
—— buchanani, *Cuv. & Val.* xviii. p. 383; *Bleeker, Cyprin.* p. 488, or *Atlas Ichthyol. Cyprin.* p. 141, tab. 43. fig. 3; *Blyth, Journ. As. Soc. Beng.* 1859, xxvii. p. 288.
—— kuhlii, *Cuv. & Val.* xviii. p. 384.
—— panchax, *Cant. Mal. Fish.* p. 252.
—— melanotopterus, *Bleek. Verhand. Batav. Genootsch.* xxiii. *Midd. & Oost-Java*, p. 22, and xxiv. *Snoek.* p. 23, and xxv. *Nalez. Ichth. Beng.* p. 144.
—— rubrostigma, *Jerdon, Madr. Journ.* xv. p. 331.

D. 8. A. 15–16. V. 6. L. lat. 32. L. transv. 9.

The length of the head is two-sevenths of the total (without caudal), and more than the height of the body. Snout rather longer than the eye.

East Indies.

a. Adult. Ganges. From Dr. McClelland's Collection.
b–c. Adult and young. Pinang. From Dr. Cantor's Collection.
d. Adult. From Dr. Bleeker's Collection.

2. Haplochilus latipes.

Pœcilia latipes, *Schleg. Faun. Jap. Pisc.* p. 224, pl. 102. fig. 5.
Aplocheilus latipes, *Bleek. Act. Soc. Sc. Indo-Neerl.* vii. *Japan*, vi. p. 99.

B. 5. D. 6. A. 19. L. lat. 29.

The height of the body equals the length of the head, and is about one-fifth of the total length (with the caudal). Dorsal fin opposite the last third of the anal; ventrals much nearer to the operculum than to the vent (which they reach if laid backwards). Coloration nearly uniform.

Japan.

a. Adult. From Dr. Bleeker's Collection.

3. Haplochilus javanicus.

Aplocheilus javanicus, *Bleek. Nat. Tydschr. Ned. Ind.* vii. p. 323, and *Cyprin.* p. 490, reprinted in *Atl. Ichthyol. Cyprin.* p. 141, tab. 43. fig. 2.

B. 5. D. 7. A. 25. L. lat. 30.

The height of the body is one-fourth or two-ninths of the total length (with the caudal), the length of the head two-ninths or one-fifth. The diameter of the eye is more than one-third of the length of the head. Dorsal fin opposite the posterior part of the anal. Greenish olive; a narrow violet streak from the head to the caudal fin.

Java.

a. Type of the species, 1½ inch long. From Dr. Bleeker's Collection.

4. Haplochilus cyanophthalmus.

Panchax cyanophthalmus, *Blyth, Journ. As. Soc. Beng.* xxvii. 1859, p. 288.

D. 7. A. 22–23.

Whitish, dotted with darker. Irides light blue. (*Blyth.*)
Calcutta. One inch and a quarter long.

a–b. One inch and a quarter long. Calcutta. From the Collection of Messrs. Schlagintweit.—We are not certain whether these specimens really belong to this species; they have 19 anal rays only, as *H. latipes*, from which they appear to differ in having a higher body; the scales are unfortunately lost, so that their number cannot be ascertained.

β. African species.

5. Haplochilus spilauchen.

Pœcilia spilauchena, *Duméril, Arch. Mus.* x. 1861, p. 258, pl. 22. fig. 6 (young).
—— bensonii, *Peters, Monatsber. Akad. Wiss. Berl.* 1864, p. 395.
? Apocheilichthys typus, *Bleek. Mém. Soc. Sc. Harlem*, 1863, *Poiss. Côte Guin.* p. 116, pl. 24. fig. 1.

D. 8. A. 13. V. 6. L. lat. 27. L. transv. 8.

The height of the body is contained thrice and a fifth in the total length (without caudal), the length of the head thrice and three-fourths. Head somewhat depressed, with the snout of moderate length, and with the jaws equal in length; mandible a little longer than the eye. The width of the interorbital space is somewhat more than one-half of the length of the head. The diameter of the eye equals the length of the snout, and is contained thrice and a third in that of the head. The origin of the dorsal fin is midway between the extremity of the caudal and the eye, corresponding to the seventeenth scale of the lateral line and to the middle of the anal. Pectoral fin extending beyond the root of the ventral, which, in females, reaches the vent. All the fins are elongate in the male sex, the dorsal and anal extending to the caudal, if laid backwards. Nearly uniform greenish olive, with a blackish spot behind the upper part of the humerus. Males have the tail ornamented with irregular silvery cross bars, and the vertical fins with fine blackish transverse lines*.
Gaboon.

a–e. Fine specimens, males and females, from 1½ to 2½ inches long. Gaboon. Purchased of Mr. Stevens.

f–h. Male and females. Gaboon. Presented by the Liverpool Free Public Museum.

We should not hesitate to unite *Apocheilichthys typus*, Bleeker, with this species, if the drawing did not represent the dorsal fin as advanced to the middle of the total length. However, this is

* The spots on the neck mentioned by Duméril as peculiar to this species are nothing but parts of the inner periosteum of the cranial bones, which in all these fishes is black.

probably an error, as, according to the description, its relative position to the anal fin is the same as in *H. spilauchen*, and as in both fishes the anal has the same position.

6. Haplochilus infrafasciatus.

D. 11. A. 14. V. 6. L. lat. 28. L. transv. 9.

The height of the body is contained four times and a half in the total length (without caudal) in a male, the length of the head thrice and two-thirds. Head much depressed, with the snout of moderate length, and with the lower jaw very slightly projecting beyond the upper; mandible much longer than the eye. The width of the interorbital space is somewhat more than one-half of the length of the head. The diameter of the eye equals the length of the snout, and is contained thrice and a fourth in that of the head. The origin of the dorsal fin is midway between the extremity of the caudal and the eye, corresponding to the nineteenth scale of the lateral line, and nearly to the middle of the anal. Pectoral fin scarcely extending beyond the root of the ventral, which, in males, reaches the anal. In the male the dorsal fin extends to the caudal, if laid backwards; the anal not. Brownish red, with a more or less distinct blackish lateral band; six blackish-brown cross bars between the band and the lower margin of the belly and tail—the first indistinct, behind the base of the pectoral, the second in front of the root of the ventrals, the third corresponding to the origin, and the fourth to the middle of the anal fin, the fifth behind the dorsal, and the sixth across the root of the caudal.

West Africa; Upper Nile (?).

a. Male, 2½ inches long. Old Calabar. Purchased of Mr. Cutter.
(?) *b*. Male, 1 inch long. Upper Nile. From Consul Petherick's Collection.

Pœcilia spilargyreia, Duméril, Arch. Mus. x. 1861, p. 258, would appear to agree very well with our specimens, but is uniformly coloured, without bands.

7. Haplochilus sexfasciatus.

Pœcilia sexfasciata, *Peters, Monatsber. Akad. Wiss. Berl.* 1864, p. 396.

D. 7. A. 14. L. lat. 24.

The height of the body is somewhat less than the length of the head, and rather more than one-fourth of the total (without caudal). Shape of the head as in the preceding species. The origin of the dorsal fin is nearer to the extremity of the caudal than to the gill-opening, corresponding to the eighteenth scale of the lateral line, and nearly to the middle of the anal. Pectoral extending beyond the root of the ventral, which reaches the vent. The free portion of the tail is very short and high, and the dorsal extends to the root of the caudal, if laid backwards. Body with six narrow black cross-bands, —the first indistinct, across the opercle; the second behind the root of the pectoral; the third corresponding to the origin, the fourth to

the middle, and the fifth to the end of the anal fin; the sixth across the root of the caudal. The three last bands extend nearly to the back of the specimen.

Liberia.

The typical specimen, 1½ inch long, is in the Berlin Museum. In spite of all the differences mentioned, it may, after all, be but the young state of *H. infrafasciatus*. This, however, cannot be decided, unless more examples be examined.

8. Haplochilus homalonotus.

Pœcilia omalonota, *Dumér. Arch. Mus.* x. 1861, p. 257, pl. 22. fig. 7.

D. 11. A. 14. V. 6.

The height of the body is contained four times in the total length (without caudal), the length of the head thrice and a third. Head and anterior part of the body low, depressed, and rather elongate, with the snout somewhat produced, the lower jaw slightly projecting beyond the upper. Eye rather shorter than the snout, two-sevenths of the length of the head. The origin of the dorsal fin is midway between the extremity of the caudal and the gill-opening, and nearly opposite to the middle of the anal. Pectoral fin extending beyond the root of the ventral. Uniform brownish red. (*Dum.*)

Noss-Bé, Madagascar.

9. Haplochilus playfairii.

D. 12. A. 18. V. 6. L. lat. 32. L. transv. 9.

The height of the body is contained four times in the total length (without caudal), the length of the head thrice and a fourth. Head rather elongate, much depressed anteriorly, the snout being somewhat longer than the eye, which is one-fourth of the length of the head, and more than one-half of the width of the interorbital space. Jaws equal in length anteriorly. The origin of the dorsal fin is midway between the extremity of the caudal and the præoperculum, corresponding to the eighteenth scale of the lateral line and to the middle of the anal. Pectoral fin scarcely extending beyond the root of the ventral, which reaches the anal. There does not appear to exist a conspicuous difference between the sexes as regards the fins. Brownish, with three or four indistinct, serrated, dark, longitudinal bands. Sometimes a black line across the base of the middle dorsal rays.

Seychelles.

a, b, c, d, e. Many specimens, from 2 to 3½ inches long. Presented by Lieut.-Col. Playfair.

γ. American species.

10. Haplochilus pulchellus.

? Pœcilia olivacea, *Storer, Synopsis*, p. 178.

? Fundulus tenellus, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 389.

? Zygonectes tenellus, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 60.
Zygonectes pulchellus, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 113.

D. 9 (8). A. 11–12 (10). V. 6. L. lat. 34. L. transv. 11–12.

The height of the body is two-ninths of the total length (without caudal), the length of the head one-fourth. Head low, depressed, and rather elongate, with the snout produced, the lower jaw scarcely projecting beyond the upper; mandible a little longer than the eye. The width of the interorbital space (which is quite flat) is a little more than one-half of the length of the head. The diameter of the eye is much less than the length of the snout, one-half of the width of the interorbital space, and contained thrice and two-thirds in the length of the head. The origin of the dorsal fin is midway between the extremity of the caudal and the orbit, and corresponds to the twenty-second scale of the lateral line. Pectoral fin extending to the ventral; ventral fin reaching the vent in males, and terminating before it in females. Origin of the anal in advance of that of the dorsal. Brownish or brownish olive, with a black band running from the snout through the eye to the middle of the base of the caudal. Back with three or four series of black dots.

The *male* has the hinder part of the dorsal and anal fins somewhat more elongate than the female. In the *female* the anterior anal rays are, with their base, within the sexual opening, which, however, is not prolonged into a tube. In the *young* the upper and lower margins of the lateral band are denticulated, instead of forming a straight well-defined line.

Southern States of North America.

a–c. Male and females, 3 inches long. From Mr. Parnell's Collection. *d.* Young. From Mr. Parnell's Collection. D. 8. A. 10.

L. Agassiz mentions the names of about eight species allied to *H. pulchellus* (*Zygonectes*), Sillim. Amer. Journ. 1854, xvii. p. 353; but as the author has omitted to properly characterize them, none of the subsequent writers were enabled to avail themselves of those names.

11. Haplochilus aureus.

Fundulus aureus, *Cope, Proc. Acad. Nat. Sc. Philad.* 1865, p. 78.

Evidently closely allied to *H. pulchellus*.

D. 10. A. 11. V. 6. L. lat. 33. L. transv. 9.

The height of the body is two-ninths of the total length (without caudal), the length of the head one-fourth; the width of the interorbital space is one-half of the length of the head. Eye large, equal to the length of the snout, and two-sevenths of that of the head. Pectorals not reaching ventrals, nor ventrals the vent (female?). Origin of the anal in advance of that of the dorsal, the latter being midway between the root of the caudal and the end of the ossa nasalia. Uniform light golden brown, below pale yellow; a brown band runs from the end of the snout to the root of the caudal. (*Cope.*)

Grosse Isle, Michigan. Specimens 2 inches long.

12. Haplochilus dovii.

D. 8. A. 14. V. 6. L. lat. 31. L. transv. 8.

The height of the body is contained five times in the total length (without caudal), the length of the head thrice and two-thirds; head elongate, low, and depressed, with the snout much produced and the upper jaw somewhat longer than the lower; the eye occupies exactly the middle of the length of the head, its diameter being two-ninths of it, and more than one-half of the width of the interorbital space, which is flat. The origin of the dorsal fin is a little nearer to the extremity of the caudal than to the gill-opening, and corresponds to the twenty-third scale of the lateral line. Anal fin entirely before the dorsal; pectoral extending to ventral, which reaches the vent; caudal rounded; all the fins well developed. Light brownish olive; posterior half of the dorsal and anal fins with black cross bands; basal half of the caudal with round light spots.

Costa Rica.

a–b. Males ? (six inches long). Punta Arena. Presented by Captain J. M. Dow.

13. Haplochilus sciadicus.

Fundulus sciadicus, *Cope, Proc. Acad. Nat. Sc. Philad.* 1865, p. 78.

D. 10. A. 12. V. 8. L. lat. 39. L. transv. 13.

Body short and stout; the length of the head two-sevenths of the total (without caudal). Eye equals the length of the snout, is two-sevenths of that of the head, and contained once and two thirds in the width of the interorbital space. Origin of the anal somewhat in advance of that of the dorsal, the latter being much nearer to the root of the caudal than to the end of the snout. Fins small. Coloration uniform, without spots or lines. (*Cope.*)

Platte River. Specimens 2 inches long.

14. Haplochilus zonatus.

?? Esox zonatus, *Mitch. Lit. & Phil. Trans.* i. p. 443.
Fundulus zonatus, *Cuv. & Val.* xviii. p. 196.

B. 5. D. 7. A. 10. V. 6.

The length of the head is two-ninths of the total (with the caudal); eye large, its diameter being two-fifths of the length of the head. The dorsal fin almost reaches the caudal, which is lanceolate. Lower part of the side with twelve black cross bars; dorsal and anal dotted with black, the other fins immaculate. (*Val.*)

Interior of South Carolina.

15. Haplochilus luciæ.

Hydrargyra luciæ, *Baird, Ninth Smithson. Report*, 1855, p. 344.

D. 8. A. 9. V. 6.

Head less than one-fourth of the total length (with the caudal). Origin of anal fin slightly in advance of that of the dorsal, and rather

more developed than the latter. Sides with ten or twelve broad, well-defined, vertical, dark bars, nearly as broad as their interspaces. Dorsal with a large black spot posteriorly, and immediately anterior to it a white one. The other fins immaculate. (*Baird.*)

New Jersey.

16. Haplochilus chrysotus.

D. 9. A. 11. V. 6. L. lat. 34. L. transv. 12.

The height of the body is one-fourth of the total length (without caudal), the length of the head two-sevenths. Head depressed anteriorly, snout shorter than the eye, which is contained thrice and a third in the length of the head, and two-thirds of the width of the interorbital space. The origin of the dorsal fin is midway between the extremity of the caudal and the eye, corresponding to about the twenty-second scale of the lateral line and the fifth ray of the anal. Pectoral fin extending to ventral, ventral fin to vent; anal and dorsal not reaching the caudal, if laid backwards. Light-olive-coloured, with narrow dark vertical streaks on the sides of trunk and tail; caudal with transverse bands of brown dots.

Charleston.

The description is taken from specimens, 1½ and 2 inches long, in the Liverpool Free Public Museum, marked with a manuscript name "*Fundulus chrysotus*, Holbrook." Of course it is impossible to know whether the specimens described are identical with those for which Holbrook intended this name; but it must be retained now for the species first *described*, of which the typical examples are in the Museum mentioned.

17. Haplochilus brasiliensis.

Fundulus brasiliensis, *Valenc. in Humb. Observ. Zool.* ii. p. 163, pl. 52. fig. 2; *Cuv. & Val.* xviii. p. 199.

B. 5. D. 8. A. 11. V. 5. L. lat. 31.

The height of the body is one-fourth of the total length (without caudal), the length of the head two-sevenths. The origin of the dorsal fin is midway between the extremity of the caudal and the eye, and somewhat behind that of the anal. Caudal fin lanceolate. Dorsal and anal somewhat elevated, the middle rays of the latter being considerably longer than the anterior ones. The lower part of the tail, between ventral and caudal, with nine or ten black cross bars. Dorsal fin with some black dots, the other fins immaculate. (*Val.*)

Brazil.

18. Haplochilus melanopleurus.

Tickiticky.

Pœcilia melapleura, *Gosse. Nat. Sqj. Jam.* p. 84, pl. 1. fig. 3.

D. 11. A. 11. V. 5. L. lat. 31. L. transv. 10.

The height of the body is contained thrice and one-third in the total length (without caudal); the length of the head thrice and two-thirds. Snout broad and obtuse, the mandible being directed

obliquely upwards; the diameter of the eye equals the length of the snout, is one-third of that of the head, and three-fifths of the width of the interorbital space. Dorsal and anal fins of moderate size; the origin of the dorsal is midway between the extremity of the caudal and the anterior margin of the orbit, and corresponds to the sixteenth scale of the lateral line; it is opposite the middle of the base of the anal. The free portion of the tail is rather short, and its depth equal to the distance between the dorsal and caudal fins. Sides of the abdomen silvery, the portion above the silvery part being black.

Jamaica.

a–e. Females from 1 to 2 inches long. Bluefields. From Mr. Gosse's Collection. Types of the species.

8. FUNDULUS*.

Fundulus, sp., *Lacép.* v. p. 37.
Hydrargyra, *Lacép.* v. p. 378; *Cuv. & Val.* xviii. p. 201.
Fundulus, *Cuv. & Val.* xviii. p. 178.

Cleft of the mouth of moderate width, developed laterally and horizontally; mandible with the bones firmly united. Upper jaw protractile. Snout of moderate length. Teeth in a narrow band, those of the outer series being largest, conical. Scales of moderate size. Dorsal fin commencing before or opposite the origin of the anal. Sexes not differentiated. Intestinal tract short. Insectivorous.

North and Central America; Tropical Africa; South Europe.

The species may be arranged thus:—

a. Species of the New World, p. 318.
β. Species of the Old World, p. 326.

a. Species of the New World.

1. Fundulus heteroclitus.

Killifish.
Cobitis heteroclita, *L. Syst. Nat.* i. p. 500; *Schoepf, Schrift. Ges. Ntrf. Freund. Berl.* 1788, p. 171, taf. 8.
—— macrolepidotus, *Art. Walb.* p. 11. no. 7.
Pœcilia cœnicola, *Bl. Schn.* p. 452.
—— fasciata, *Bl. Schn.* p. 453.
Fundulus mudfish, *Lacép.* v. pp. 37, 38.
Esox pisciculus, *Mitch. Lit. & Phil. Trans. New York.* i. p. 440.
Fundulus cœnicolus, *Valenc. in Humb. Obs. Zool.* ii. p. 162; *Cuv. & Val.* xviii. p. 179, pl. 530.
Fundulus fasciatus, *Valenc., Humb. Obs. Zool.* ii. p. 162, pl. 52. figs. 1, 4, 5 (not synon.).
Hydrargira ornata, *Lesueur, Journ. Ac. Nat. Sc. Philad.* 1817, i. p. 131; *Storer, Synops. Fish. North Amer.* p. 181.

* 1. Fundulus virescens, *Schleg. Faun. Japon. Poiss.* p. 225. pl. 102. fig. 6.—Japan. Known from a figure only (*Fundulichthys virescens*, Blkr.)

Fundulus zebra, *Dekay, Nat. Hist. New York, Fish.* p. 218; *Baird, Ninth Smithson. Report*, 1855, p. 342.
—— viridescens, *Dekay, l. c.* p. 217, pl. 31. fig. 99.
?? Fundulus fonticola, *Cuv. & Val.* xviii. p. 198.
Fundulus grandis, *Baird & Gir. Proc. Acad. Nat. Sc. Philad.* 1853, p. 389, *and U. S.* and *Mex. Bound. Ichthyol.* p. 69, pl. 36.
—— floridensis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 157.

B. 5. D. 11. A. 11. L. lat. 35. L. transv. 15–16.

The height of the body equals the length of the head, and is contained thrice and two-thirds in the total length (without caudal); males have the body comparatively shorter. Snout rather obtuse, the mandible being directed obliquely upwards. The diameter of the eye is two-thirds of the length of the snout, one-fifth of that of the head, and rather less than one-half of the width of the interorbital space, in large specimens; in younger examples the snout is shorter. Dorsal and anal of moderate size, higher in males than in females. The origin of the dorsal is midway between the extremity of the caudal and the anterior margin of the orbit in females, but in males it is exactly in the middle of the total length; it corresponds to the seventeenth scale of the lateral line; it is distinctly in advance of the vertical from the base of the anal, the first anal ray being below the fourth of the dorsal. Coloration uniform (in spirits).

The opening tube of the oviduct is attached to the anterior rays of the anal fin.

Southern States of North America.

a–e. Adult females (5 inches long) and young. Lake Pontchartrain.

Specimens, two inches long, sent by Prof. Agassiz under the name of *Fundulus spilotus* (Holbr.), to the Liverpool Free Public Museum, appear to me to be the young of *F. heteroclitus*; they are obscurely spotted on the sides, and have a black dot in the middle of the last dorsal rays.

2. Fundulus parvipinnis.

Girard, Proc. Acad. Nat. Sc. Philad. 1854, p. 154.

D. 11. A. 11. V. 5. L. transv. 12.

The height of the body is a little less than one-fifth of the total length (with the caudal), the length of the head a little less than one-fourth. The diameter of the eye equals the length of the snout, and is one-fourth of that of the head. Origin of the dorsal fin midway between the extremity of the caudal and the end of the snout; origin of the anal fin opposite the middle of the dorsal. Fins small. A black stripe on the middle of the side, from the anterior third of the body to the base of the caudal. (*Gir.*)

San Diego, California.

3. Fundulus labialis.

B. 6. D. 13–14. A. 16–17. V. 6. L. lat. 37–39. L. transv. 15.

The height of the body, taken on the level of the base of the pec-

toral, is two-ninths of the total length (without caudal). Head rather depressed, its length being contained four times or four times and a third in the total. Interorbital space broad, slightly convex, its width being less than one-half of the length of the head. Snout broad, obtuse, depressed, with the jaws perfectly equal in front; mandible very short, not longer than the eye. Upper lip well developed, broad, extending to the angle of the mouth. The diameter of the eye is less than the length of the snout, or than one-fourth of that of the head, and, in females, one-half of the width of the interorbital space, whilst in males the forehead is somewhat narrower. The origin of the dorsal fin is midway between the extremity of the caudal and the orbit, and corresponds to the twentieth scale of the lateral line. The first anal ray is opposite to the first of the dorsal. Dorsal fin as high as long in both sexes; anal fin rounded in the male, scarcely higher than long, much elevated in the female, the length of its base being two-thirds only of its depth. Genital opening of the female immediately in front of, but disconnected from, the anal fin. Basal third of the caudal fin (which is subtruncate) scaly. Body uniform brownish olive, paler below; sometimes irregular cloudy markings on the tail. Fins immaculate; the anal fin of the male is black at the base, and bright yellow on its marginal half; also the upper margin of the dorsal fin of the same sex is yellowish.

Guatemala.

a–c. Males, 4 inches long. Guatemala. From Mr. Salvin's Collection.

d–f. Females, from 4 to 4½ inches long. Rio San Geronimo. From Mr. Salvin's Collection.

g–h. Females, 3 inches long. Yzabal. From the Collection of Messrs. Salvin and Godman.

4. Fundulus punctatus.

D. 12. A. 13. V. 6. L. lat. 34. L. transv. 12.

The height of the body, taken on the level of the base of the pectoral, is two-ninths of the total length (without caudal). Head depressed, its length being one-fourth of the total. Interorbital space very broad, slightly convex, its width being one-half of the length of the head. Snout broad, obtuse, much depressed, with the lower jaw scarcely projecting beyond the upper; mandible longer than the eye. Upper lip of moderate breadth, not extending to the angle of the mouth. The diameter of the eye is less than the length of the snout, two-ninths of that of the head, and less than one-half of the width of the interorbital space. The origin of the dorsal fin is somewhat nearer to the extremity of the caudal than to the orbit, and corresponds to the nineteenth scale of the lateral line. The first anal ray is opposite to the third of the dorsal. Dorsal and anal fins subquadrangular, with the outer margins convex: both are a little longer than high. Caudal fin subtruncate, scaly on its basal half. Pectoral fins shorter than the head (without snout), not ex-

tending to the base of the ventrals. Brownish-olive, paler below; each scale, especially those on the tail, with a vertical dark-purplish-violet spot on the centre. Dorsal with three or four series of blackish dots, anal with a whitish margin.

Chiapam.

a. Male, 3½ inches long. From Mr. Salvin's Collection.

5. Fundulus guatemalensis.

D. 12 (13). A. 14–15 (16). L. lat. 32–35. L. transv. 12.

The height of the body, taken on the level of the base of the pectoral, equals the length of the head, and is one-fourth or rather more than one-fourth, of the total length (without caudal). Head thick and broad; interorbital space broad, slightly convex, its width being a little less than one-half of the length of the head. Snout broad, obtuse, with the lower jaw slightly projecting beyond the upper; mandible longer than the eye. The diameter of the eye is equal to, or, in the larger specimens, less than the length of the snout, one-fourth of that of the head, and one-half of the width of the interorbital space. The origin of the dorsal fin is midway between the extremity of the caudal and the posterior margin of the orbit, and corresponds to the nineteenth scale of the lateral line. The first anal ray corresponds to the second of the dorsal. Dorsal and anal fins subquadrangular, rather low, longer than high in the male, and as long as high in the female. Two-thirds of caudal covered with small scales. Brown above and on the sides, pale below; females with a very indistinct dark band along the side. Fins immaculate; anal with a light margin.

The sexual opening of the female is not attached to the anterior anal rays.

Guatemala; Western Ecuador.

a. Many specimens, 3 inches long. Lake of Dueñas. From Mr. Salvin's Collection.

b. Several specimens, 2–3 inches long. Lake of Amatitlan. From Mr. Salvin's Collection.

c. Male, 3½ inches long. Rio Guacalate. From Mr. Salvin's Collection.

d. Many specimens, from 3 to 3½ inches long. Western Ecuador. From Mr. Fraser's Collection.

6. Fundulus pachycephalus.

This species is closely allied to *F. guatemalensis*, but has a thicker head and smaller eye.

D. 13–14. A. 15. V. 6. L. lat. 35. L. transv. 12.

The height of the body, taken on the level of the base of the pectoral, is contained thrice and one-fifth or thrice and four-fifths in the total length (without caudal). Head very thick and broad, its length being contained thrice and one-third in the total. Interorbital space very broad, slightly convex, its width being one-half

of the length of the head. Snout broad, obtuse, with the lower jaw slightly projecting beyond the upper; mandible longer than the eye. The diameter of the eye is less than the length of the snout, one-fourth of that of the head, and one-half of the width of the interorbital space. The origin of the dorsal fin is midway between the extremity of the caudal and the anterior or posterior margin of the orbit, and corresponds to the sixteenth scale of the lateral line. The first anal ray corresponds to the third of the dorsal. Dorsal and anal fins subquadrangular, of moderate height, the latter fin being scarcely higher than long. Caudal fin subtruncate. Brownish above and on the sides, each scale darker on the tip; an indistinct dark band along the middle of the tail. Fins immaculate, anal with the lower margin whitish.

Guatemala.

a–c. Males, 2½ inches long. Lake of Atitlan. From Mr. Salvin's Collection.

7. Fundulus catenatus.

Poecilia catenata, *Storer, Synopsis*, p. 178.

D. 14. A. 15. V. 5. L. lat. 44. L. transv. 12.

The height of the body is contained five times in the total length (without caudal), the length of the head thrice and two-thirds; the diameter of the eye is somewhat less than the length of the snout, two-thirds of the width of the interorbital space, and one-fourth of the length of the head. Dorsal fin as high as long; its origin being nearer to the extremity of the caudal than to that of the snout, and in advance of that of the anal. Anal fin large, much deeper than long (in a female). A brown line runs along each series of scales.

Alabama; Tennessee.

We have had opportunity of examining only the female sex of this species.

8. Fundulus majalis.

Mayfisch, *Schoepf, Schrift. Ges. Nfrf. Freund.* viii. p. 173.
Cobitis majalis, *Art., Walb.* p. 12.
Poecilia majalis, *Bl. Schn.* p. 453.
Esox flavulus, *Mitch. Lit. & Phil. Trans. New York*, i. p. 439, pl. 4. fig. 8.
Cyprinodon flavulus, *Valenc. in Humb. Obs. Zool.* ii. p. 164, pl. 52. figs. 3, 6, & 7.
Hydrargyra trifasciata, *Storer, Journ. Soc. Nat. Hist. Boston*, i. 1837, p. 417.
—— flavula, *Storer, Mem. Amer. Ac.* v. pl. 25. figs. 5 & 6; *Baird, Ninth Smithson. Report*, 1855, p. 344.
Fundulus fasciatus, *Dekay, New York Faun. Fish.* p. 216, pl. 31. fig. 98.
Hydrargyra majalis, *Cuv. & Val.* xviii. p. 207.

B. 6. D. 13–16. A. 11. V. 6. L. lat. 35. L. transv. 13.

The height of the body is one-fourth of the total length (without caudal), the length of the head two-sevenths. Head low, and rather elongate, with the snout produced, the lower jaw scarcely projecting beyond the upper; mandible longer than the eye. The width of

the interorbital space is contained twice and three-fifths in the length of the head. The diameter of the eye is two-thirds of the length of the snout or of the width of the interorbital space, and one-fifth of the length of the head. The origin of the dorsal fin is midway between the extremity of the caudal and the anterior or posterior margin of the orbit, and corresponds to the sixteenth scale of the lateral line. The first anal ray corresponds to the second of the dorsal fin. Anal much higher than long. Greenish, with three more or less interrupted irregular longitudinal bands in the female, and with many broad cross bands in the male.

United States.

a, *b*. Three inches long. From the Haslar Collection.
c. Four and a half inches long. Old Collection.

Hydrargyra vernalis, Cuv. & Val. xviii. p. 206, pl. 531, appears to be identical with *H. majalis*, differing from it in its coloration only, having a dozen vertical black stripes on the sides of the body.

9. Fundulus similis.

Hydrargyra similis, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 389, and in *U. S. & Mex. Bound. Ichthyol.* p. 68, pl. 35. figs. 1–8.

D. 13. A. 9. L. lat. 31. L. transv. 13.

The height of the body is one-fourth of the total length (without caudal), the length of the head one-third; eye one-fifth of the length of the head. Head low and elongate, snout produced, the lower jaw scarcely projecting beyond the upper. The origin of the dorsal fin is midway between the extremity of the caudal and the anterior or posterior margin of the orbit, somewhat in advance of the anal. Anal fin much higher than long, especially in the male. Body with nine narrow black cross bars in the female; dorsal fin of the male with a small black spot on its hinder margin.

Indianola, Texas, Florida.

This species is very closely allied to *F. majalis*, but would appear to differ in the number of the fin-rays and in the coloration. We have examined an adult female in the Liverpool Free Public Museum.

10. Fundulus swampinus.

Hydrargira swampina, *Lacép.* v. p. 378, pl. 10. fig. 3; *Cuv. & Val.* xviii. p. 203.

B. 6. D. 14. A. 12. V. 6. L. lat. 43.

The height of the body is nearly one-fifth of the total length (with the caudal), the length of the head two-ninths. Head quite flat above, the width of the interorbital space being scarcely more than that of the orbit, which is somewhat less than one-third of the length of the head. Lower jaw slightly prominent. Caudal truncate. Greenish olive, with a silvery longitudinal band, and with twelve or fifteen blackish vertical streaks. (*Val.*)

South Carolina.

11. Fundulus multifasciatus.

Hydrargyra multifasciata, *Lesueur, Journ. Acad. Nat. Sc. Philad.* i. 1817, p. 131.

Fundulus multifasciatus, *Cuv. & Val.* xviii. p. 200; *Cope, Proc. Acad. Nat. Sc. Philad.* 1865, p. 78.

D. 14. A. 12. L. lat. 45.

The height of the body is contained four times and a half in the total length (without caudal), the length of the head thrice and three-fourths. Origin of the dorsal in advance of that of the anal, nearer to the extremity of the snout than to that of the caudal; pectoral extending somewhat beyond the base of the ventral. Body with about fifteen olive-brown cross bands.

United States.

a. One inch and a half long. Freshpond, Cambridge. Presented by Th. Moore, Esq.

12. Fundulus pisculentus.

Esox pisculentus, *Mitch. Lit. & Phil. Trans. New York*, i. p. 441.

? Hydrargyra diaphana, *Lesueur, Journ. Ac. Nat. Sc. Philad.* i. 1817, p. 130.

Fundulus pisculentus, *Cuv. & Val.* xviii. p. 190; *Storer, Mem. Am. Ac.* v. p. 294, pl. 23. figs. 3 & 4.

D. 11–14. A. 13–12. V. 6. L. lat. 34.

Body elongate, its height being two-elevenths of the total length (with the caudal); the length of the head is two-ninths of the same. Eye large, its diameter being two-sevenths of the length of the head. Lower jaw prominent. Dorsal square, low behind, its origin being somewhat behind the middle of the total length, and conspicuously in advance of that of the anal. Caudal truncate. Olive-coloured above, paler below, sides dotted with black.

Tidal waters of the United States.

a. Female, 2¾ inches long. Salem Harbour, Massachussetts. Presented by Th. Moore, Esq.

13. Fundulus zebra.

Hydrargyra zebra, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 60 (not *Fundulus zebra*, Dekay).

D. 13. A. 14. V. 5.

The length of the head is two-ninths of the total (with the caudal); body elongate. Eye one-fourth of the length of the head. Dorsal fin longer than high, its origin, in the male, being nearly midway between the end of the snout and the hinder margin of the caudal, whilst in the female it is situated more posteriorly, but always in advance of the origin of the anal. Anal fin as long as deep in the male, and deeper than long in the female; its anterior margin, in the female, is overlapped by the termination of the oviduct. About sixteen black cross bars, somewhat narrower than the interspaces,

and more conspicuous in the male than in the female on the side of the body. Fins immaculate. (*Girard.*)

Upper affluents of the Rio Grande del Norte.

14. Fundulus nigrofasciatus.

Hydrargyra nigrofasciata, *Lesueur, Journ. Ac. Nat. Sc. Philad.* 1817, i. p. 133; *Storer, Rep. Fish. Massach.* p. 94.

Fundulus nigrofasciatus, *Cuv. & Val.* xviii. p. 193.

D. 10–11. A. 9. L. lat. 33. L. transv. 11–12.

The height of the body is contained four times and a fifth in the total length (without caudal), the length of the head thrice and two-thirds; head thick, snout obtuse. The diameter of the eye is more than the length of the snout, two-thirds of the width of the inter-orbital space, and contained thrice and one-third in the length of the head. Dorsal and anal fins of moderate size, the former not much higher than long, the latter being considerably elevated. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the fourteenth scale of the lateral line. The first anal ray is below the third of the dorsal. Caudal rounded. Mandible about as long as eye. Brownish olive above and on the sides, silvery below; fins immaculate.

Males with nine or ten very distinct silvery cross bars, each about as broad as a scale.

Females with more or less numerous narrow black vertical stripes on the side, which do not extend on to the back or the belly.

United States.

a–c. Males and female, from 2 to 2½ inches long. From Mr. Parnell's Collection.

15. Fundulus seminolis.

Fundulus seminolis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 59.

D. 17. A. 14. V. 6.

The height of the body equals the length of the head, which is contained four times and one-third in the total (with the caudal); snout tapering; the diameter of the eye two-ninths of the length of the head. The dorsal fin is longer than high, higher posteriorly than anteriorly, and its origin is nearer to the end of the snout than to the extremity of the caudal. The tip of the anal extends further backwards than that of the dorsal. Pectoral nearly reaching the vertical from the base of the ventral. Yellowish brown, spotted with black; the spots corresponding to the scales, on the line of their intersection. Dorsal and caudal spotted, anal immaculate, with the margin blackish. (*Girard.*)

Palatka, East Florida. Known from a male only.

β. Species of the Old World.

16. Fundulus hispanicus.

Hydrargyra hispanica, *Cuv. & Val.* xviii. p. 214, pl. 531. fig. 1 (fem.); *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1865, lii. figs. 4–5.

D. 10–11. A. 12–14. L. lat. 29–32. L. transv. 8–9.

The height of the body is a little less than the length of the head, and somewhat more than one-fourth of the total (with the caudal). The diameter of the eye equals the length of the snout, and is nearly one-fourth of that of the head. Dorsal and anal fins well developed. The origin of the dorsal is nearer to the root of the caudal than to the gill-opening, and opposite to that of the anal. Caudal rounded. Scales of the upper part of the trunk with a blackish spot at the base, the spots being more distinct in the male than in the female.

Fresh waters of Spain.

Bellotti, *Mem. Accad. Sc. Torin.* 1858, xvii. p. clx, considers this species to be the female of *Cyprinodon iberus*—which is evidently an error.

17. Fundulus orthonotus.

Cyprinodon orthonotus, *Peters, Monatsber. Akad. Wiss. Berl.* 1844, p. 35.

Hydrargyra maculata, *Peters, Wiegm. Arch.* 1855, p. 269.

D. 15. A. 15–16. V. 5. L. lat. 30–32. L. transv. 10.

The height of the body is about equal to the length of the head, which is contained thrice and one-third in the total length (without caudal). Head thick, short, with the snout obtuse, the lower jaw projecting beyond the upper. Diameter of the eye about equal to the extent of the snout, one-half of the interorbital space, and two-ninths of the length of the head. The origin of the dorsal fin is midway between the root of the caudal and the eye in males, and equidistant between the root of the caudal and the præoperculum in females. The origin of the anal is opposite to that of the dorsal in males, and somewhat more backwards in females, in which, besides, the anterior anal rays are stiff and inflexible. The male has the vertical fins and the pectorals much more elongate than the female. Specimens of this sex have all the scales provided with a more or less broad, beautiful carmine-red margin. Sides of the head and the dorsal and anal fins with carmine-red spots. Caudal entirely red. Females have the tail and the base of the anal and caudal dotted with black.

East coast of Africa.

a–b. Adult male and female. Mozambique. From the Berlin Museum.

c. Adult male. Quillimane. Presented by Dr. Kirk.

d. Adult male. Zanzibar. Presented by Colonel Playfair.

e. Several males. Pangani River. Presented by Colonel Playfair.

f–g. Adult females. Seychelles. Presented by Colonel Playfair.

9. RIVULUS.

Rivulus, *Poey, Mem. Cub.* ii. p. 307.

Cleft of the mouth small, with the upper jaw but slightly protractile, snout not produced; both jaws with an outer series of curved teeth and an inner band of villiform teeth. Scales of moderate size. Dorsal fin shorter than, and behind, the anal. Sexes not differentiated by modification of the anal fin. Intestine very short and simple. Air-bladder none. Frequently an ocellated spot on the upper part of the root of the caudal fin.

Tropical America.

1. Rivulus cylindraceus.

Poey, Mem. Cub. ii. p. 308.

B. 6. D. 9. A. 12. L. lat. 40.

The height of the body is contained five times and one-half in the total length (with the caudal), the length of the head three times and three-quarters; the diameter of the eye is more than the length of the snout, and two-sevenths of the length of the head. The origin of the dorsal fin is on the third fifth of the total length. Caudal truncated. Greenish, with an ocellated, black, yellow-edged spot on the upper part of the root of the caudal. (*Poey.*)

Havanna.

2. Rivulus urophthalmus.

D. 6. A. 9. V. 6. L. lat. 38. L. transv. 11.

Trunk subcylindrical, head depressed and obtuse, tail compressed. The length of the head is two-ninths of the total (without caudal); the height of the body two-elevenths. Snout rounded, with the jaws equal in length, nearly as long as the eye, the diameter of which is one-fourth, or, in the younger examples, more than one-fourth, of the length of the head. Mandible as long as the eye. Interorbital space quite flat, its width being half the length of the head. Dorsal fin situated far backwards, its origin being opposite to the end of the anal fin, and its distance from the gill-opening exceeding double the length of the head. Ventral fins very small, about as long as the eye, but reaching the vent. Pectoral terminating at a great distance from the ventral. Light-brownish olive; caudal striolated with brown. Generally a black, white-edged ocellus on the upper part of the root of the caudal.

Brazil.

a–d. Males, from 1½ to 2 inches long. Para. Purchased of Mr. Stevens.

3. Rivulus micropus.

? Fundulus micropus, *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1863, xlviii. p. 184.

Closely allied to *Fundulus urophthalmus*.

D. 8. A. 16. V. 6. L. lat. 36.

The length of the head is one-fourth of the total (without caudal),

the height of the body two-elevenths. Snout rounded, with the jaws equal in length, somewhat shorter than the eye, which is one-third or two-sevenths of the length of the head. Mandible as long as the eye. Interorbital space quite flat, its width being half the length of the head. Dorsal fin situated far backwards, opposite to the posterior third of the anal; and its distance from the gill-opening equals double the length of the head. Ventral fins very small, not much longer than the eye, and reaching the vent. Pectoral terminating at a great distance from the ventral. Light brownish: body with a longitudinal series of dark-brown dots, two of the series being very conspicuous. Vertical fins striolated with blackish brown. Generally a black, white-edged ocellus on the upper part of the root of the caudal.

Rio Negro; Venezuela; Trinidad.

a–b. One inch and a half long. Venezuela. From Mr. Dyson's Collection.

c. One inch and a half long. Trinidad. Presented by Lechmere Guppy, Esq.

10. ORESTIAS.

Orestias, *Cuv. & Val.* xviii. p. 221.

Ventral fins none. Cleft of the mouth of moderate width, directed upwards, with the lower jaw prominent, and with the upper protractile. Both jaws with a narrow band of small conical teeth. Scales rather small or of moderate size, those on the head and upper part of the trunk frequently enlarged, plate-like, and granulated. Dorsal and anal fins moderately developed, opposite to each other. Sexes not differentiated by modification of the anal fin. Intestinal tract but little convoluted. The gill-membranes of both sides are united for a short distance, and not attached to the isthmus.

Alpine lakes of the Andes.

1. Orestias cuvieri.

Orestias cuvieri, *Cuv. & Val.* xviii. p. 225, pl. 532.
—— humboldtii, *Cuv. & Val.* xviii. p. 233, pl. 534 (half-grown).

B. 5. D. 14–16. A. 18–19. L. lat. 50.

Body rather elongate than stout. Head twice as long as high, its length being only one-third of the total (without caudal); in young specimens it is somewhat shorter. Eye of moderate size, one-fifth of the length of the head in large examples, and one-fourth in younger ones. The snout is produced, rather longer than the eye; præorbital nearly square. The scales on the cheek leave a broad ring round the eye and a large space behind the maxillary uncovered. Adult specimens with the scales on the head and the upper part of the trunk granular. The length of the posterior limb of the præoperculum is less than two-thirds of that of the lower. Pectoral terminating at a great distance from the vent. The distance between the dorsal and caudal fins is about equal to the length of the base of the former.

Lake Titicaca.

a. Female, 8 inches long. From Mr. Pentland's Collection.
b–d, e–g. Half-grown and young. From Mr. Pentland's Collection.

2. Orestias pentlandii.

Cuv. & Val. xviii. p. 230, pl. 533, cop. by *Casteln. Anim. Amér. Sud, Poiss.* pl. 27. fig. 2.

D. 13–15. A. 16–17. L. lat. 60.

Body rather elongate than stout; head three-fifths as high as long, its length being one-fourth of the total (without caudal). Eye rather small, nearly one-sixth of the length of the head in large examples, and one-fourth in younger ones. Snout of moderate length, longer than the eye, truncate, the lower jaw being vertically directed upwards; præorbital subquadrangular, rather longer than high. The scales on the cheek leave a broad ring round the orbit and a large space behind the maxillary uncovered. Adult specimens have the scales on the head and the upper part of the trunk but slightly granular, and only those of a series running above the operculum are conspicuously enlarged. The length of the posterior limb of the præoperculum is more than two-thirds of that of the lower. Pectoral terminating at a great distance from the vent. The distance between the dorsal and caudal fins is more than the length of the base of the former.

Lake Titicaca.

a–b. Females, 7½ inches long. From Mr. Pentland's Collection.
c. Several young and half-grown specimens. From Mr. Pentland's Collection.

3. Orestias jussiei.

Cuv. & Val. xviii. p. 235, pl. 535, cop. by *Casteln. Anim. Amér. Sud, Poiss.* pl. 27. fig. 3.

D. 14. A. 15. L. lat. 33.

Body rather stout, neck elevated and much arched; head nearly three-fourths as high as long, its length being contained thrice and a third in the total (without caudal); anterior part of the head compressed: snout as long as the eye, truncate, the lower jaw being vertically directed upwards. Eye one-fourth of the length of the head in a specimen 3½ inches long. Præorbital irregular in shape, deeper than long. Cheeks entirely covered with hard, horny scales; the scales on the trunk and on the head are enlarged, very thick and horny, but smooth. The length of the posterior limb of the præoperculum nearly equals that of the lower. Pectoral terminating at some distance from the vent. The distance between dorsal and caudal fins equals the length of the base of the former.

Lake Titicaca.

a. Three and a half inches long. From Mr. Pentland's Collection.

4. Orestias owenii.

Orestias owenii, *Cuv. & Val.* xviii. p. 241.
—— agassizii, *Cuv. & Val.* xviii. p. 238, pl. 536.
—— tschudii, *Casteln. Anim. Amér. Sud, Poiss.* p. 51, pl. 27. fig. 1.

D. 14–15. A. 13–16. L. lat. 35.

Body rather stout, neck slightly arched; head nearly three-fourths as long as high, its length being a little more than one-fourth of the total (without caudal). Eye of moderate size, one-fourth of the length of the head in a specimen 4 inches long. Snout of moderate length, as long as the eye, obtuse, the lower jaw being obliquely directed upwards. Præorbital irregular in form, higher than long; it is crossed by a series of pores running all round the orbit; another series along the limb of the præoperculum. The scales on the cheek advance to below the eye and to the præorbital; the scales on the head and on the trunk are, in adult specimens, somewhat enlarged, thick and horny, but smooth. The length of the posterior limb of the præoperculum equals that of the lower. Pectoral terminating at some distance from the vent. The distance between dorsal and caudal fins equals the length of the base of the former.

Lake Titicaca.

a, b, c, d, e. Many specimens, from 2 to 3½ inches long. Lake Titicaca. From Mr. Pentland's Collection.

f–i. From 2 to 3 inches long. Lake d'Urcos. From Mr. Pentland's Collection.

5. Orestias mülleri.

Orestias mülleri, *Cuv. & Val.* xviii. p. 240 (half-grown).
—— albus, *Cuv. & Val.* xviii. p. 242, pl. 537.

D. 12–14. A. 13–15. L. lat. 32.

Body stout, neck elevated and arched; head two-thirds as high as long, its length being one-third, or in adult specimens a little more than one-third, of the total (without caudal); snout rather short, as long as the eye, truncate, the lower jaw being vertically directed upwards. Eye one-fifth or one-sixth of the length of the head in specimens 6 inches long, and two-sevenths in specimens of 3 inches. Præorbital subtriangular, higher than long, broadest below. The scales on the cheek leave a broad ring round the orbit and a large space behind the angle of the mouth uncovered; the scales on the head and on the trunk are, in adult specimens, enlarged, strongly granulated, very thick and horny. The length of the posterior limb of the præoperculum equals that of the lower. Pectoral terminating at a short distance from the vent. The distance between dorsal and caudal fins is equal to, or rather more than, the length of the base of the former.

Lake Titicaca.

a–f. Adult female (6 inches long) and half-grown examples. Lake Titicaca. From Mr. Pentland's Collection.

g. Half-grown. Andes de S. Antonio. From Mr. Pentland's Collection.

Valenciennes mentions rigid papillæ on the tongue and palate as a specific character of *Orestias müller*i, by which he distinguishes it from the other species. I find these papillæ in all young examples, but never in adult ones.

6. Orestias luteus.

? Orestias luteus, *Cuv. & Val.* xviii. p. 243.

D. 14. A. 13. L. lat. 39.

Body rather stout, neck slightly arched; head three-fifths as long as high, its length being contained thrice and a fourth in the total (without caudal). Eye of moderate size, not much less than one-third of the length of the head in a specimen 3⅓ inches long. Snout of moderate length, shorter than the eye, slightly obtuse, the lower jaw being somewhat obliquely directed upwards; præorbital subquadrangular, deeper than long, without pores. Scales on the cheek in a narrowish band. The length of the posterior limb of the præoperculum is considerably less than that of the lower. Pectoral terminating at some distance from the vent. The distance between dorsal and caudal fins is more than the length of the base of the former.

Lake Titicaca.

a. Three inches and a third long. From Mr. Pentland's Collection.

11. JENYNSIA.

Lebias, sp., *Jenyns*.

Cleft of the mouth small, developed laterally and horizontally; mandible short, with the bones firmly united. Snout not produced. Both jaws with a series of tricuspid teeth of moderate size. Scales of moderate size. The origin of the anal fin is, in both sexes, behind that of the dorsal, although the anal of the male is modified into an intromittent organ, in which scarcely any of the rays remain distinct. Intestinal tract but slightly convoluted.

Rio Plata.

Although Mr. Darwin's Collection contained males as well as females, Mr. Jenyns omitted to mention the former, probably considering the anal appendage to be an accidental mutilation of the fin.

1. Jenynsia lineata.

Labias lineata, *Jenyns, Voy. Beagle, Fish.* p. 116, pl. 22. fig. 2.

D. 9. A. 9. V. 6. L. lat. 30. L. transv. 8.

The height of the body is one-fifth of the total length (with the caudal), the length of the head two-ninths. Head depressed; snout obtuse; mouth small; upper jaw very protractile; the lower one rather the longer. Diameter of the eye two-sevenths of the length of the head. The origin of the dorsal fin corresponds exactly to the middle of the total length, and is somewhat in advance of that of the

anal. Anal appendage of the male shorter than the head. Pectorals small, about two-thirds of the length of the head, reaching to the root of the ventrals. Greenish brown, with six or seven longitudinal dark lines on the sides, the lines apparently made up of spots for the most part confluent, but here and there not so, interrupting the continuity of the lines. Fins immaculate.

Maldonado.

12. PSEUDOXIPHOPHORUS.

Pseudoxiphophorus, *Bleek. Ichthyol. Archipel. Ind. Prodr. Cypr.* p. 483.
Pœciliodes, *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1863, xlviii. p. 176.

Cleft of the mouth developed more horizontally than laterally; bones of the mandible firmly united; snout not produced, with the lower jaw scarcely prominent; both jaws with a band of small conical teeth, those of the outer series being the strongest. Scales rather large. Dorsal fin rather long and many-rayed. Anal below the anterior part of the dorsal, not much in advance of it in the male, in which it is modified into an intromittent organ. Intestinal tract short. Carnivorous.

Central America.

1. Pseudoxiphophorus bimaculatus.

Xiphophorus bimaculatus, *Heckel, Sitzgsber. Akad. Wiss. Wien*, 1848, i. 3. p. 169, taf. 6. figs. 1 & 2.
Pœciliodes bimaculatus, *Steindachner*, ibid.* 1863, xlviii. p. 176, taf. 4. fig. 2.

B. 6. D. 14–15. A. 10–11. L. lat. 29. L. transv. 8.

The height of the body is equal to or rather more than the length of the head, which is contained from four times and a half to four times and two-thirds in the total length (without caudal). Head broad, the width of the interorbital space (which is flat) being one-half of the length of the head; the diameter of the eye equals the length of the snout, and is one-fourth or somewhat more than one-fourth of the length of the head. The length of the base of the anal is two-fifths of that of the dorsal. In the male the anal is opposite the origin of the dorsal, the process being nearly twice as long as the head, and terminating in a small hook. Each scale with a submarginal brown crescent. A black spot behind the upper end of the gill-opening, and a round blackish patch on the upper half of the root of the caudal.

Mexico.

a–c. Male (2½ inches) and females (4 inches). From M. Sallé's Collection.
d. Several specimens.
e–g. Males. Purchased of Mr. Frank.
h. Female. Cordova. Purchased of M. Parzudaki.

* This author omits to mention that the same fish has been described from specimens in the same Museum under the same specific name.

2. Pseudoxiphophorus reticulatus.

Pseudoxiphophorus reticulatus, *Troschel, in Müller's Reis. Mex.* iii. App. p. 104.

D. 16. A. 8 (male).

Known from a male only.

The height of the body is one-sixth of the total length (with the caudal); anal process without hooks. The pectoral extends to the end of the base of the anal. Coloration as in the preceding species; caudal fin entirely blackish. (*Trosch.*)

13. BELONESOX.

Belonesox, *Kner, Sitzgsber. Akad. Wiss. Wien*, 1860, xl. p. 419.

Cleft of the mouth much developed laterally, the jaw-bones being much produced; the intermaxillaries form together an elongate triangular plate, but are not anchylosed together. Mandible long, somewhat prominent; both jaws with a broad band of cardiform teeth. Scales of moderate size. Anal in advance of dorsal, and modified into an intromittent organ in the male. Intestinal tract short. Carnivorous.

Central America.

1. Belonesox belizanus.

Kner, l. c. (c. tab.).

B. 6. D. 9. A. 10–11. V. 6. L. lat. 56–63. L. transv. 18.

The height of the body is one-sixth or rather more than one-fifth of the total length (without caudal), the length of the head one-third or more than one-third; the upper surface of the intermaxillary plate is as long as the postorbital part of the head. The length of the base of the dorsal fin is more than one-half of its distance from the caudal in males, and one-half in females. Brownish olive above; sides with longitudinal series of black dots; a round black spot on the root of the caudal.

The anal process of the male is composed of three rays, and two-thirds as long as the head.

Honduras; Mexico; Guatemala.

a–b. Males, 4 and 2½ inches long. Mexico. From M. Sallé's Collection.
c. Female. Mexico. From Mr. Cuming's Collection.
d–e. Females, 7 inches long. Lake Peten. From Mr. Salvin's Collection.

14. GAMBUSIA*.

Gambusia, *Poey, Mem. Cub.* i. 1851, p. 382.

Cleft of the mouth developed laterally and horizontally; bones

* 1. Gambusia speciosa, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 121.—Rio San Diego, New Leon.
2. —— senilis, *Girard, l. c.*—Chihuahua River.
3. —— gracilis, *Troschel, in Müller, Reise Mex.* App. iii. p. 107.—Prof. Troschel has kindly informed me that this fish may prove to be a *Rivulus*, but, owing to the state of the specimen, it cannot be ascertained whether it has an air-bladder or not.

of the mandible firmly united. Snout not produced, with the lower jaw more or less prominent. Both jaws with a band of teeth, those of the outer series being the strongest and conical. Scales rather large. Origin of the anal fin more or less in advance of that of the dorsal. Anal fin of the male modified into an intromittent organ and much advanced. Intestinal tract but little convolute. Carnivorous.

West Indies; southern parts of North America.

1. Gambusia punctata.

Poey, l. c. p. 384, lam. 32. figs. 5–9.

B. 6. D. 10. A. 11. V. 6. L. lat. 35. Vert. 13/20.

The height of the body is contained thrice and three-fourths in the total length (without caudal), the length of the head four times and one-sixth. Lower jaw projecting beyond the upper. The eye is one-third of the length of the head, and one-half of the width of the interorbital space. In the female the origin of the dorsal fin is midway between the extremity of the caudal and the front margin of the orbit, and opposite to the seventh or eighth anal ray. In the male the origin of that fin is in the middle of the total length. Anal process of the male shorter than the head. Pectoral fins not quite reaching as far as the ventrals. The length of the base of the anal fin of the female is one-half of its distance from the caudal. The upper half of the body and the dorsal fin with series of black dots. (*Poey.*)

Cuba.

2. Gambusia puncticulata.

Poey, l. c. p. 386, lam. 31. figs. 6–7.

B. 6. D. 9. A. 11. V. 6. L. lat. 30. Vert. 13/19.

The height of the body is contained thrice and two-thirds in the total length (without caudal), the length of the head four times. Lower jaw projecting beyond the upper. The eye is one-third of the length of the head. In the female the origin of the dorsal fin is midway between the extremity of the caudal and the centre of the eye, and opposite to the middle of the anal fin; in the male the origin of that fin is in the middle of the total length. Anal process of the male longer than the head. Pectoral and ventral fins short. The free portion of the tail rather deep. Body with scattered black dots. An oblique blackish band below the eye. Dorsal and caudal fins with transverse series of black dots. (*Poey.*)

Cuba.

3. Gambusia holbrookii.

? Heterandria patruelis, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 390.

? Gambusia patruelis, *Girard, U. S. & Mex. Bound. Ichthyol.* p. 72, pl. 39. figs. 1–7, and *Proc. Acad. Nat. Sc. Philad.* 1859, p. 121.

Gambusia holbrookii, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 61.

D. 8–9. A. 9–10. V. 6. L. lat. 32. L. transv. 8.

The height of the body is contained thrice and one-half in the

total length (without caudal), the length of the head thrice and two-thirds. Snout broad, subspatulate, with the lower jaw projecting beyond the upper. The diameter of the eye is somewhat more than the length of the snout, one-third of that of the head, and two-thirds of the width of the interorbital space. In the female the origin of the dorsal fin is midway between the extremity of the caudal and the front margin of the orbit, and opposite to the seventh anal ray. In the male the origin of that fin is in the middle of the total length. Anal process of the male longer than the head, not curved at its extremity. Pectoral fins reaching nearly as far back as the ventrals, which terminate immediately in front of the anal fin. Free portion of the tail rather elongate, the length of the base of the anal fin of the female being conspicuously less than one-half of its distance from the caudal fin. A faint dark line runs from the superciliary, above the opercle, along the upper half of the trunk. Frequently a series of black dots, and sometimes other dots irregularly scattered, on the side of the body. Two or three transverse bands of dots on the dorsal and caudal fins. An oblique brownish band below the orbit. Frequently uniform brownish olive.

Southern States of North America.

a. Many female specimens, 1½ or 2 inches long. New Orleans.
b. Many male specimens, 1 or 1¼ inches long. United States. From Mr. Parnell's Collection.
c, *d*. Many female specimens, 1½ or 2 inches long. United States. From Mr. Parnell's Collection.
e. Adult female. North America. Presented by E. Doubleday, Esq.

4. Gambusia humilis.

Gambusia gracilis, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 121 (not *Heckel*).

D. 6. A. 9. V. 6.

Body slender; the length of the head a little more than one-fifth of the total (with the caudal). Caudal rounded; anal larger than dorsal, its end being nearly opposite to the origin of the dorsal. Ventrals extending nearly to the anal; pectorals beyond the base of the ventrals. Olive-brown, dorsal and caudal with narrow blackish cross bars. (*Girard.*)

Matamoras.

5. Gambusia nobilis.

Heterandria nobilis, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 390.

Gambusia nobilis, *Girard, U. S. & Mex. Bound. Ichthyol.* p. 71, pl. 39. figs. 8–11, and *Proc. Acad. Nat. Sc. Philad.* 1859, p. 120.

D. 8. A. 7. V. 6*.

The height of the body is contained thrice and one-third in the total length (without caudal), the length of the head thrice and one-half. Origin of the dorsal fin in the middle of the total length.

* D. 9. A. 8, according to the figure.

Anal fin much smaller than, but commencing somewhat in advance of, the dorsal. Ventral very small; pectoral terminating at some distance from the anal. Coloration uniform. (*Girard.*)

Texas.

6. Gambusia affinis.

Heterandria affinis, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 390.

Gambusia affinis, *Girard, U. S. & Mex. Bound. Ichth.* p. 72, pl. 39. figs. 12–15.

D. 6. A. 8*.

The height of the body is scarcely more than the length of the head, which is one-fourth of the total (without caudal). Origin of the dorsal fin a little nearer to the extremity of the snout than to that of the caudal fin. Anal fin similar to dorsal in size and in shape, its origin being but little in advance of that of the dorsal. Ventrals slender, extending considerably further backwards than the pectoral. Dorsal and caudal more or less dotted with black. (*Girard.*)

Texas.

7. Gambusia gracilis.

Xiphophorus gracilis, *Heckel, Sitzgsber. Akad. Wiss. Wien*, 1848, i. part 3. p. 300, taf. 9. figs. 3–4.

D. 8. A. 8–9. V. 6. L. lat. 29. L. transv. 7.

The height of the body equals the length of the head, which is one-fourth of the total (without caudal); in the female the body is somewhat deeper. The origin of the dorsal fin is nearly in the middle of the total length, and but little behind that of the anal fin in the female. Anal process of the male nearly twice as long as the head, with the extremity bent. Pectorals reaching beyond the root of the ventrals. Anal fin short in the female, the length of its base being at least one-third of its distance from the caudal. A dark band runs from the upper end of the gill-opening to the caudal. (*Heck.*)

Orizaba (Mexico).

8. Gambusia nicaraguensis.

D. 8. A. 10. L. lat. 29. L. transv. 8.

The height of the body is contained thrice and a third in the total length (without caudal), the length of the head thrice and two-thirds. Snout broad, subspatulate, with the lower jaw projecting beyond the upper. The diameter of the eye is a little more than the length of snout, one-third of that of the head, and three-fifths of the width of the interorbital space. In the female the origin of the dorsal fin is somewhat nearer to the extremity of the caudal than to the end of the snout, and opposite to the last ray of the anal fin. Pectoral fins not quite reaching as far backwards as the ventrals, which terminate immediately in front of the anal fin. Free portion of the tail rather short, the length of the base of the anal fin being one-half of its dis-

* D. 7. A. 9, according to the figure.

tance from the caudal fin. Brownish olive above, sometimes with series of black dots along the rows of scales. Dorsal and caudal fins crossed by series of black dots; middle of anal blackish.

Lake of Nicaragua.

a. Several females, 1½ or 2 inches long. Presented by Captain Dow.

15. ANABLEPS.*

Anableps, *Artedi, Genera*, p. 25.

Head broad and depressed, with the supraorbital part very much raised. Body elongate, depressed anteriorly and compressed posteriorly. Cleft of the mouth horizontal, of moderate width, the mandible being short, having, however, its bones firmly united; upper jaw protractile. Both jaws armed with a band of villiform teeth, those of the outer series being largest and somewhat moveable. The integuments of the eye are divided into an upper and lower portion by a dark-coloured transverse band of the conjunctiva; also the pupil is incompletely divided into two by a pair of lobes projecting from each side of the iris. Nasal opening produced into a short tubule depending from each side of the mouth. Scales rather small or of moderate size. Dorsal and anal fins short, the former behind the latter. The anal fin of the male is modified into a thick and long scaly conical organ with an orifice at its extremity. Intestinal tract but little convoluted. The gill-membranes of both sides are united for a short distance, and not attached to the isthmus.

Fresh waters of Central America and of the tropical parts of South America.

1. Anableps tetrophthalmus.

Anableps, *Artedi in Seba*, iii. p. 108, tab. 34. f. 7, and *Genera*, p. 25; *Synon.* p. 43; *Gronov. Zoophyl.* p. 117. no. 360, tab. 1. figs. 1–3, and *Mus.* i. p. 12. no. 32.

Cobitis anableps, *L. Syst. Nat.* i. p. 499.

Anableps tetrophthalmus, *Bl.* viii. p. 7, tab. 361; *Bl. Schn.* p. 389, tab. 76.

—— surinamensis, *Lacép.* v. p. 26.

—— gronovii, *Cuv. & Val.* xviii. p. 252, pls. 538, 539.

—— lineatus, *Gronov. Syst.* ed. *Gray*, p. 192.

Anatomy: *Lacép. Mém. Instit. Nat. Sc. Math. Phys.* ii. p. 372 (eye); *Meckel, Deutsch. Arch. Physiol.* 1818, iv. p. 124 (eye); and *Valenciennes, l. c.*

Development: *Wyman, Proc. Bost. Soc. Nat. Hist.* 1854, v. p. 80, and *Bost. Journ. Nat. Hist.* 1857, vi. p. 432.

B. 5. D. 9. A. 9. P. 22. V. 6. L. lat. 50–55. Vert. 25/26–28.

The length of the head is two-ninths of the total (without caudal). The flat bottom part of the interorbital space is nearly as broad as a scale. Sides of the body with five, and of the tail with three, blackish longitudinal bands.

Guianas.

* Anableps elongatus, *Cuv. & Val.* xviii. p. 267. pl. 541.—Cayenne.

a–d, *e*, *f*, *g*. Adult males and females, and young. British Guiana.
h–k. Adult male and females. Dutch Guiana. Purchased of Mr. Frank.
l–n. Males (10 inches long) and female. Trinidad. Purchased of Mr. Cutter.
o. Adult male: skeleton. British Guiana. Presented by T. Bell, Esq.

2. Anableps dovii.

Anableps dowei, *Gill, Proc. Acad. Nat. Sc. Philad.* 1861, p. 4.

D. 9. A. 10. L. lat. 65. Vert. 24/22.

The length of the head is one-fourth of the total (without caudal). The flat bottom part of the interorbital space is at least as broad as a scale. Back and sides of the body blackish brown, with a well-defined, broad, yellowish-white band from the axil of the pectoral to the base of the caudal.

a–b. Fine female specimens, from 9 to 10 inches long. Chiapam. From Mr. Salvin's Collection.
c, *d*. Adult female and young. Guatemala. From the Collections of Mr. Salvin and Capt. Dow.
e–g. Half-grown. Not in good state. From the Haslar Collection.
h. Mature fœtus, taken from specimen *h*.
i. Adult female: skeleton. Chiapam. From Mr. Salvin's Collection.

3. Anableps microlepis.

Anableps microlepis, *Müll. & Trosch. Monatsber. Akad. Wiss. Berl.* 1844, p. 35.
—— coarctatus, *Cuv. & Val.* xviii. p. 266, pl. 540.
Anableps, *J. P. G. Smith, Proc. Zool. Soc.* 1850, p. 53.
Anatomy: *Home, Lect. on Compar. Anat.* vi. (1828) tabb. 38, 52, 53.

D. 10–11. A. 10. L. lat. 84–90.

The length of the head is two-ninths of the total (without caudal). The space between the raised supraorbital portions is extremely narrow. Sides of the body and tail uniform silvery, or with indistinct greyish longitudinal bands.

Guianas.

a–f. Adult males and females. Surinam. Presented by Sir E. Home.
g–i. Adult and half-grown. British Guiana. Presented by J. B. G. Smith, Esq.

Second Group. CYPRINODONTIDÆ LIMNOPHAGÆ.

The bones of each mandibulary are not united; intestinal tract with numerous convolutions. Sexes differentiated. Mud-eating.

16. POECILIA*.

Poecilia, sp. *Bl. Schn.* p. 452.
Limia, *Poey, Mem. Cub.* ii. p. 383.
On the Development and Anatomy, see *Duvernoy, Ann. Sc. Nat.* 1844, 3e sér. i. p. 313.

Cleft of the mouth small, transverse; mandible very short, with the bones not united, the dentary being moveable. Snout not produced. Both jaws with a narrow band of minute teeth, those of the outer series being the largest and somewhat moveable. Scales rather large. Origin of the anal fin generally nearly opposite to that of the dorsal in the female, but in the male it is modified into an intromittent organ and much advanced. Dorsal fin short, with not more than eleven rays. Intestinal tract with numerous convolutions. Mud-eating.

West Indies; Central and South America.

1. Poecilia vittata.

Fanguito.
Poecilia vittata, *Guichen. in Ramon de la Sagra, Hist. Nat. Cuba, Poiss.* p. 146, pl. 5. fig. 1.
Limia vittata, *Poey, Mem. Cub.* i. p. 389, lam. 31. figs. 14–16.

D. 10. A. 10. L. lat. 32. L. transv. 10. Vert. 13/16.

The height of the body is contained thrice and one-third in the total length (without caudal), the length of the head four times. The origin of the dorsal fin is nearer to the occiput than to the root of the caudal, and, in the female, in advance of that of the anal. Dorsal of moderate size, anal small. In the male, the origin of the anal is nearly equidistant between the end of the snout and the root of the caudal, and the pectoral does not extend to the anal. Tail moderately elongate, its free portion being much longer than high. Two series of dark dots along the side of the body.

Havannah.

* 1. Xiphophorus gillii, *Kner & Steindachner, Monatsber. Akad. Wiss. Münch.*; and *Abhandl. Bayr. Akad. Wiss.* 1864 (1866), x. taf. 4. fig. 1.—Rio Chagres.
2. Molinesia fasciata, *Müll. & Trosch. Monatsber. Akad. Wiss. Berl.* 1844, p. 36.—Mexico.
3. —— surinamensis, *Müll. & Trosch. l. c.*

2. Pœcilia cubensis.

Guajica.

Limea cubensis, *Poey Mem. Cub.* i. p. 388, lam. 32. figs. 10, 11, lam. 31. figs. 12, 13.

D. 10–11. A. 10–11. L. lat. 30. L. transv. 10. Vert. 13/16.

Scarcely different from *P. vittata*.

The height of the body is a little less than one-third of the total length (without caudal), the length of the head one-fourth. The diameter of the eye is more than the length of the snout, and one-third of that of the head. The origin of the dorsal fin is nearer to the occiput than to the root of the caudal, and, in the female, in advance of that of the anal. Dorsal and anal of moderate size. In the male the origin of the anal is much nearer to the end of the snout than to the root of the caudal, and before the extremity of the pectoral; its longest ray is provided with an adipose apical appendage. Tail moderately elongate, its least depth being not much less than the length of the head. Two series of black dots along each side of the body. Dorsal and caudal with irregular black spots. (*Poey.*)

Havannah.

3. Pœcilia mexicana.

Pœcilia mexicana, *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1863, xlviii. p. 178, taf. 4. fig. 1.

D. 10. A. 9. L. lat. 28. L. transv. 9–10.

The height of the body is contained thrice and a third in the total length (without caudal), the length of the head four times; the diameter of the eye (of full-grown specimens) is equal to, or scarcely less than, the extent of the snout, two-sevenths of the length of the head, and one-half of the width of the interorbital space; in half-grown or young examples it is somewhat longer. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the twelfth scale of the lateral line. Origin of the dorsal fin slightly in advance of that of the anal. Dorsal fin rather small, anal very small; basal half of the caudal scaly. Tail compressed, high, its least depth being equal to, or rather more than, the length of the head, without snout. There are eight longitudinal series of scales on each side of the tail. Lateral line very indistinct. Brownish green; each scale of the four middle series of the trunk with a small central black spot. Dorsal with numerous round blackish spots; caudal with an indistinct whitish cross band, near its hind margin.

Males are comparatively scarce; they want the black spots on the sides, and have the anal fin transformed into an intromittent organ.

Central America.

a–b. Females, 4 and 5 inches long. Chiapam. From Mr. Salvin's Collection.

c. Many specimens, females, 2–3 inches long. Dueñas. From Mr. Salvin's Collection.

d–g. Females, 3½ inches long. River Chisoy, Vera Paz. From Mr. Salvin's Collection.

h. Many specimens, females, 2–3 inches long. Lake of Amatitlan. From Mr. Salvin's Collection.

i. Many specimens, 1–2½ inches long, mostly females, and three males. Lake of Amatitlan. From Mr. Salvin's Collection.

4. Poecilia thermalis.

Poecilia thermalis, *Steindachner, Sitzgsber. Akad. Wiss. Wien*, 1863, xlviii. p. 181, taf. 4. figs. 3, 3 *a*.

?Gambusia (?) modesta, *Troschel, in Müller's Reis. Mex.* iii. p. 105.

Very closely allied to *P. dovii*, but with a broader head, with the body more elongate, &c.

D. 9–10. A. 8–9. L. 30. L. transv. 9.

The height of the body (measured between the origins of the dorsal and anal fins) is contained thrice and three-fourths in the total length (without caudal), and equals the length of the head; the width of the interorbital space equals the distance between the front margin of the orbit and the gill-opening. The diameter of the eye is a little more than the length of the snout, contained thrice and one-third in that of the head, and a little more than one-half of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the twelfth scale of the lateral line. Origin of the anal opposite to the third ray of the dorsal in the female. Dorsal fin of moderate size, anal small; caudal scaly at the base only. Tail compressed, moderately elongate, its least depth being somewhat less than the length of the head, without snout. There are seven longitudinal series of scales on each side of the tail. Lateral line rather distinct. Greenish, a faint darker streak along each series of scales; frequently a round blackish spot in the middle of the side in females.

The *male* has the dorsal fin elevated, and the longest ray is at least as long as the head, without snout; this fin is ornamented with large, ovate black spots, occupying the lower half of the fin, and sometimes confluent into one large patch. Anal fin modified into an intromittent organ, and advanced to between the ventrals and in front of the dorsal. Tail strongly compressed, and comparatively rather higher than in the female. Interradial membrane of the caudal fin with oblong black spots, nothing of which is visible in the female.

Central America.

a. Females, from 1½ to 2½ inches long. San Salvador, warm springs. Presented by Capt. Dow.

b. Males, 2 inches long. Presented by Capt. Dow.

Prof. Troschel informs me that his *Gambusia* (?) *modesta* ought to be referred to *Poecilia* as characterized above; but it is not quite certain whether it is specifically identical with *P. thermalis*.

5. Pœcilia chisoyensis.

We know this species from the male sex only.

D. 9–10. A. ?. L. lat. 29. L. transv. 9.

The height of the body is contained thrice and a third in the total length (without caudal), the length of the head four times and a third; the free portion of the tail is elevated, its least depth being two-thirds of its own length, and more than the length of the head, without snout. The diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and more than one-half of the width of the interorbital space. Origin of the dorsal fin nearer to the occiput than to the root of the caudal, behind that of the anal, above the twelfth scale of the lateral line. Dorsal fin higher than long, but its longest ray is shorter than the head. The enlarged anal ray without terminal appendage. There are eight longitudinal series of scales on each side of the tail. Caudal rather short, its basal half covered with scales. Uniform greenish, with golden reflections; dorsal and caudal black.

River Chisoy, Vera Paz.

a–c. Males, 3½ inches long. From the Collection of Messrs. Godman & Salvin.

6. Pœcilia elongata.

Known from a female only.

D. 9. A. 8. L. lat. 30–32. L. transv. 9.

The height of the body is contained four times in the total length (without caudal), the length of the head four times and a third. The free portion of the tail is elevated, its least depth being contained once and two-thirds in its own length, and a little less than the length of the head, without snout. The diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and more than one-half of the width of the interorbital space. Snout much depressed. Lower jaw with a single series of very small teeth only; and also in the upper the posterior band of villiform teeth is very indistinct. Origin of the dorsal fin nearer to the root of the caudal than to the occiput, a little behind that of the anal, above the fourteenth scale of the lateral line. Dorsal fin higher than long, its longest ray being as long as the head, without snout. Anal small. There are eight longitudinal series of scales on each side of the tail. Caudal rounded, its base only covered with scales. Uniform greenish; the membrane of the pouches of scales with a black margin. Fins immaculate.

Panama.

a. Female, 5 inches long. Presented by Capt. Dow.

7. Pœcilia petenensis.

D. 11. A. 8. L. lat. 29–30. L. transv. 8–9. Vert. 16/14.

The height of the body (measured below the anterior dorsal rays)

is contained four times and one-fifth in the total length (without caudal) in females, and thrice and one-fourth in males, the males having the body much higher and shorter. The length of the head is one-fifth of the same length in the female, and one-fourth in the male. The diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and somewhat more than one-half of the interorbital space. The origin of the dorsal fin is further distant from the root of the caudal than from the occiput, and corresponds to the eleventh or twelfth scale of the lateral line. Origin of the anal opposite to the fourth ray of the dorsal (in the female). Dorsal fin of moderate size, anal rather small, but pointed; caudal scaly in its basal third. The free portion of the tail is compressed, rather high, its least depth being one-half of its length, and equal to the length of the head, without snout. There are seven longitudinal series of scales on each side of the tail. Lateral line rather indistinct. Greenish, each scale with a black vertical spot. Dorsal and basal half of the anal irregularly and finely marbled with brown.

The *male* has the dorsal fin somewhat elevated, the longest ray being rather longer than the head. Anal fin modified into an intromittent organ, and advanced to between the ventrals, in front of the dorsal. Tail strongly compressed, and much higher than in the female, its least depth being equal to the length of the head.

Lake Peten.

a–b. Male (5 inches long) and females (6 inches long). From Mr. Salvin's Collection.

c–d. Males, 4 inches long. From Mr. Salvin's Collection.

e. Female, 5 inches long: skeleton. From Mr. Salvin's Collection.

8. Poecilia sphenops.

Poecilia sphenops, *Cuv. & Val.* xviii. p. 130, pl. 526.

D. 9. A. 8. L. lat. 28. L. transv. 8.

The height of the body is contained thrice and a third in the total length (without caudal), the length of the head thrice and two-thirds; the diameter of the eye equals the length of the snout, is two-sevenths of that of the head, and a little more than one-half of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the thirteenth scale of the lateral line. Origin of the anal opposite to that of the dorsal (in the female). Dorsal fin of moderate size, anal small; caudal scaly at the base only. Tail compressed, rather high, its least depth being equal to the length of the head, without snout. There are eight longitudinal series of scales on each side of the tail. Lateral line rather indistinct. Greenish, each scale darker at the base. Back of the tail with narrow, irregular silvery cross bars.

The *male* has the dorsal fin somewhat elevated, but the longest ray is scarcely as long as the head, without snout; this fin is ornamented with round black spots. Anal fin modified into an intromittent organ, and advanced to between the ventrals. Tail strongly compressed, and comparatively higher than in the female. Caudal

fin with oblong black spots on the interradial membrane of the basal half, with a broad whitish posterior marginal band, and narrow black edge.

The *female* has the dorsal only spotted with black.

Mexico. Vera Cruz.

a–b, *c–e*. Males, 2 to 3 inches long. From M. Sallé's Collection.
f–g. Females, 2 inches long. Vera Cruz. Purchased of Mr. Cuming.

9. Pœcilia dovii.

? Gambusia (?) plumbea, *Troschel, in Müller, Reise Mex.* iii. p. 106.

Closely allied to *P. sphenops*, but with the snout shorter, and the anal situated more backwards.

D. 9. A. 8. L. lat. 26–29. L. transv. 9.

The height of the body is contained thrice and two-fifths in the total length (without caudal), the length of the head thrice and three-fifths; the width of the interorbital space is rather less than the distance between the front margin of the eye and the gill-opening. The diameter of the eye is somewhat more than the length of the snout, two-sevenths of that of the head, and rather more than one-half of the width of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the twelfth scale of the lateral line. Origin of the anal opposite to the second or third ray of the dorsal (in the female). Dorsal fin of moderate size, anal small; caudal scaly in its basal third. Tail compressed, rather high, its least depth being equal to the length of the head, without snout. There are seven longitudinal series of scales on each side of the tail. Lateral line rather indistinct. Uniform brownish green on the head and body.

The *male* has the dorsal fin slightly elevated, but the longest ray is scarcely as long as the head, without snout; this fin is ornamented with small round black spots. Anal fin modified into an intromittent organ, and advanced to between the ventrals and in front of the dorsal. Tail strongly compressed, but not higher than in the female. Caudal fin with minute black spots on the interradial membrane. Back of the tail sometimes with indistinct narrow dark cross bars.

The *female* has the fins coloured as the male.

Guatemala; Mexico.

a. Several male and female specimens: males 2 inches long, females 2½ inches. Lake of Nicaragua. Presented by Captain Dow.
b. Several specimens, from 2 to 2½ inches long. Lake of Amatitlan. From Mr. Salvin's Collection.
c–d. Females, 3 inches long. Mexico. From M. Sallé's Collection.

Prof. Troschel informs me that his *Gambusia* (?) *plumbea* belongs to this genus; but it is uncertain whether it is specifically identical with *P. dovii*.

10. Poecilia vivipara.

Poecilia vivipara, *Bl. Schn.* p. 452, tab. 86. fig. 2; *Peters, Monatsber. Akad. Wiss. Berlin*, 1864, p. 396.
—— surinamensis, *Valenc. in Humboldt, Observ. Zool.* ii. p. 158, pl. 51. fig. 1; *Cuv. & Val.* xviii. p. 120.
—— schneideri, *Cuv. & Val.* xviii. p. 135.

B. 5. D. 7. A. 7. L. lat. 24. Vert. 15/13.

The height of the body is one-third of the total length (without caudal); the diameter of the eye is one-third of the length of the head, or one-half of the width of the interorbital space. Greenish, each scale with the margin brownish; dorsal fin with a small blackish spot in the middle; caudal with a black spot near the base of the upper and lower rays.

Brazil; Guyanas; Martinique.

11. Poecilia spilurus.

Known from a female only.

D. 7. A. 8. L. lat. 26. L. transv. 9.

The height of the body is two-sevenths of the total length (without caudal); the length of the head one-fourth; the width of the interorbital space is a little less than the distance between the gill-opening and the centre of the eye; the diameter of the eye is more than the length of the snout, one-third of that of the head, and three-fifths of the width of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the upper end of the gill-opening, corresponding to the thirteenth scale of the lateral line. Origin of the anal fin distinctly in advance of that of the dorsal (in the female); dorsal and anal fins small; base of the caudal fin covered with scales. Tail of moderate height, its least depth being equal to the length of the head (without snout). Brownish olive, each scale darker in the centre; a black spot on each side of the back of the root of the tail; dorsal fin with a few black spots along the middle.

Central America.

a. Female, 2½ inches long.

12. Poecilia melanogaster.

Known from females only.

D. 8. A. 8. L. lat. 26. L. transv. 8.

The height of the body (measured between the origins of the dorsal and anal) is contained thrice and a third in the total length (without caudal), the length of the head thrice and three-fourths; the diameter of the eye of full-grown specimens is somewhat more than the extent of the snout, contained thrice and one-fourth in the length of the head, and more than one-half of the width of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the eleventh

scale of the lateral line. Origin of the dorsal fin scarcely in advance of that of the anal. Dorsal and anal fins small; base of the caudal scaly. Tail of moderate length, its least depth being scarcely equal to the length of the head, without snout. There are seven longitudinal series of scales on each side of the tail. Lateral line very indistinct.

Body light brownish, a silvery vertical streak on each scale. A small blackish spot in the middle of the root of the caudal; a blackish spot across the base of the three posterior dorsal rays. The prominent belly of females silvery in its anterior half, and deep black in its posterior, both colours being sharply separated from each other.

Habitat ——?

a–e. Females, from 2 to 2⅓ inches long. North America?, Jamaica? From Mr. Parnell's Collection.

13. Pœcilia dominicensis.

Pœcilia dominicensis, *Cuv. & Val.* xviii. p. 131, pl. 525.

D. 8. A. 7–8. L. lat. 28. L. transv. 8.

The height of the body is contained thrice and two-thirds in the total length (without caudal), the length of the head four times. The origin of the dorsal fin is a little nearer to the root of the caudal than to the occiput, and nearly opposite to that of the anal. Dorsal and anal fins small, rounded. Tail of moderate height, its least depth being less than the length of the head (without snout). A dark line along the middle of the back; sometimes irregular indistinct blackish spots on the back. Caudal with two light-brownish cross bands.

San Domingo; Barbadoes. Known from the female only.

a. Female, 2½ inches long. Barbadoes. Purchased of Mr. Cuming.
b. Female, 2 inches long. San Domingo.

14. Pœcilia unimaculata.

Pœcilia unimaculata, *Valenc. in Humb. Observ. Zool.* ii. p. 158, pl. 51. fig. 2; *Cuv. & Val.* xviii. p. 128; *Jenyns, Zool. Beagle, Fish.* p. 114.

D. 7. A. 7. L. lat. 27. L. transv. 7.

The height of the body is contained thrice and one-third in the total length (without caudal), the length of the head thrice and two-thirds; the diameter of the eye is scarcely more than the extent of the snout, two-sevenths of the length of the head, and a little more than one-half of the interorbital space. The origin of the dorsal fin is midway between the root of the caudal and the occiput, and corresponds to the twelfth scale of the lateral line. Origin of the anal opposite to that of the dorsal. Dorsal and anal fins small, rounded; caudal scaly at the base only. Tail compressed, rather high, its least depth being equal to the length of the head, without snout. There are seven series of scales on each side of the tail. Lateral

line very indistinct. A round black spot on the middle of the side, on the seventh and eight scales of the lateral line.

Rio Janeiro; British Guyana.

a–c. Females, 1½–2½ inches long. Rio Janeiro. Voyage of the 'Herald.'

d. Female, 3½ inches long. British Guyana. Presented by Sir R. Schomburgk.

15. Pœcilia punctata.

Pœcilia punctata, *Cuv. & Val.* xviii. p. 133.

D. 9. A. 6. L. lat. 31.

Tail elongate; anal high and pointed. Body with four or five longitudinal series of small black spots. (*Val.*)

Montevideo. Specimen 15 lines long.

16. Pœcilia couchii.

Limia couchiana, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 116.

D. 9. A. 6.

Known from females only.

Body rather short, back convex. The length of the head is one-fifth of the total (with the caudal); eye one-third of the length of the head. Dorsal fin longer than high, its origin being nearer to the root of the caudal than to the extremity of the snout; its entire base is placed on the posterior declivity of the back. Anal opposite the hinder portion of the dorsal; pectorals not extending to the ventral. Brown, an obsolete blackish band along the side; dorsal with a few blackish spots, the other fins immaculate. (*Girard.*)

Rio San Juan (Province of New Leon.)

17. MOLLIENESIA.

Mollinesia, *Lesueur, Journ. Ac. Nat. Sc. Philad.* 1821, ii. p. 3.
Xiphophorus, sp., *Heckel.*

Closely allied to *Pœcilia*. Cleft of the mouth small, transverse; mandible very short, with the bones not united, the dentary being moveable. Snout not produced. Both jaws with a band of minute teeth, those of the outer series being the largest and somewhat moveable. Scales rather large. Origin of the anal fin behind that of the dorsal in both sexes, the anal of the male being modified into an intromittent organ. Dorsal fin large, larger in the male than in the female, with twelve or more rays. Intestinal tract with numerous convolutions. Mud-eating.

Central America and southern parts of North America.

The species may be subdivided thus:—

a. Caudal of both sexes alike: *Mollienesia*, p. 348.

β. The lower caudal rays of the male prolonged into a long, sword-shaped appendage: *Xiphophorus*, p. 349.

a. Mollienesia.

1. Mollienesia latipinna.

Mollinesia latipinna, *Lesueur, Journ. Acad. Sc. Philad.* 1821, ii. p. 3, pl. 3 (male).

Mollienisia latipina, *Cuv. & Val.* xviii. p. 139, pl. 527 (male, anal fin incorrect).

Pœcilia multilineata, *Lesueur, l. c.* p. 4, pl. 1; *Cuv. & Val.* xviii. p. 134 (fem.); *Agass. Sillim. Amer. Journ.* 1853, xvi. p. 135, and 1855, xix. p. 133.

? Pœcilia lineolata, *Girard, U. S. & Mex. Bound. Ichthyol.* p. 70, pl. 35. figs. 9–11, and in *Proc. Acad. Nat. Sc. Philad.* 1859, p. 114.

B. 5. D. 14. A. 9 (female). V. 6. L. lat. 30. L. transv. 8.

The height of the body is a little less than one-third of the total length (without caudal), the length of the head somewhat more than one-fourth. The diameter of the eye is equal to the length of the snout, two-sevenths of that of the head, and one-half of the width of the interorbital space. The dorsal fin of the male is one-half of the distance between eye and root of the caudal; in the female it is one-third only. Caudal rounded, without scales. The free portion of the tail is as high as long, and covered by eight longitudinal series of scales on each side. Lateral line very indistinct. Greenish, or brownish green, silvery below; a dark line along each series of scales, and the lower part of the trunk with a series of round brownish spots besides. Each scale with a silvery hinder margin. Dorsal fin with four or five brown lines, interrupted by the rays, and with a row of vertically ovate spots on its upper half. Interradial membrane of the caudal with black dots; the lower part of the hind margin black.

Louisiana, Florida. ? Texas.

a. Male, 2½ inches long. New Orleans.
b–c. Females: skins in spirits. North America.

Limia matamorensis, Girard, Proc. Acad. Nat. Sc. Philad. 1859, p. 116, from Matamoras, is not sufficiently distinguished from *M. latipinna*.

Limia pœciloides, Girard, U. S. & Mex. Bound. Ichthyol. p. 70, pl. 38. figs. 8–11 (but not figs. 12–14), and Proc. Acad. Nat. Sc. Philad. 1859, p. 115, from Texas. This fish has quite the appearance of a young male of *M. latipinna*; or it may prove to be the male of *Limia venusta*, Girard, U. S. & Mex. Bound. Ichthyol. p. 71, pl. 39. figs. 20–23 = *Lucania venusta*, see p. 310.

2. Mollienesia petenensis.

B. 6. D. 15. A. 8–9. L. lat. 30. L. transv. 10. Vert. 17/13.

The height of the body is one-third of the total length (without caudal), the length of the head one-fourth or two-ninths. The diameter of the eye is equal to the length of the snout, two-sevenths of that of the head, and rather less than one-half of the width of the interorbital space. The length of the dorsal fin of the male is

one-half of the distance between eye and root of the caudal, in the female two-fifths; caudal rounded, with scales at the base only. The free portion of the tail is as high as long, and covered by nine longitudinal series of scales on each side. Lateral line very indistinct. Greenish, or brownish green, silvery below; a dark spot to each scale of the upper and middle caudal series and the lower part of the trunk. Dorsal fin of the adult male with small irregular brown lines or spots, and with a row of large rounded spots along the middle of its height. Interradial membrane of the caudal with numerous black dots; the lower part of the hind margin black. Females and immature males have the dorsal fin simply ornamented with small irregularly curved brown spots.

Lake Peten.

a, *b*. Several male specimens (from 4 to 5 inches long) and one female, (4½ inches long). From Mr. Salvin's Collection.

c. Adult male: skeleton. From Mr. Salvin's Collection.

Although this species is very closely allied to *M. latipinna*, it is evidently distinct, having constantly fifteen dorsal rays and a different coloration.

3. Mollienesia formosa.

Limia formosa, *Girard, Proc. Acad. Nat. Sc. Philad.* 1859, p. 115.

D. 12–13. A. 10.

Male. The height of the body is nearly equal to the length of the head, which is one-fourth of the total (with the caudal); the diameter of the eye is one-third of the length of the head; snout abbreviated. Dorsal fin longer than high; anal fin nearly opposite the anterior margin of the dorsal; ventrals in advance of dorsal.

Female. Dorsal fin nearly as high as long, with the anterior margin somewhat nearer the root of the caudal than the extremity of the snout. Anal fin opposite the posterior portion of the dorsal. Pectoral extending beyond the origin of the ventral.

Dorsal fin with transverse series of blackish spots, the other fins immaculate. (*Gir.*)

Paolo Alto (Mexico).

β. Xiphophorus.

1. Xiphophorus hellerii.

Xiphophorus hellerii, *Heckel, Sitzgsber. Akad. Wiss. Wien*, 1848, i. part 3. p. 163, pl. 5 (male, young male, and female).

B. 5. D. 13. A. 9. V. 6. L. lat. 29. L. transv. 8. Vert. 16/14.

The height of the body is contained from thrice and one-half to thrice and four-fifths in the total length (without caudal), the length of the head four times and one-third. The diameter of the eye is equal to the length of the snout, and two-sevenths of that of the head; in males it is scarcely equal to one-half of the width of the interorbital space, whilst it is somewhat less in females. Dorsal fin in males and females of nearly equal length, viz. two-sevenths of the distance between head and caudal fins; it is somewhat ele-

vated in males. Caudal fin rounded, with the basal third scaly; the lower rays of the caudal fin of the male are produced into a long sword-shaped appendage which in the adult is nearly as long as the body of the fish. Ventral immediately below the origin of the dorsal in both sexes. Anal of the male modified into an intromittent organ, one or two of the enlarged rays having several hook-like processes at their extremities. The free portion of the tail is two-thirds as high as long in males, and a little lower in females. Lateral line indistinct. Caudal appendage of the male yellow, with black edges.

Central America.

Var α.

Two yellowish-green bands along the side, separated, and bordered above and below, by a blue band.

a–b, c–d. Males and females. River Chisoy. From the Collection of Messrs. Godman and Salvin.

e. Male: skeleton. River Chisoy.

Var. β.

The middle blue band darkest, black, running from the eye to, and along the upper border of, the caudal appendage.

f, g–l. Adult males. Cordova.

m. Halfgrown male. Mexico. From M. Sallé's Collection. Caudal appendage very short.

Var. γ.

Body without bands, covered all over with irregular black spots.

n–q. Males. River Chisoy. From the Collection of Messrs. Godman and Salvin.

18. PLATYPŒCILUS.

Cleft of the mouth small, transverse, mandible very short, with the bones not united, the dentary being moveable. Snout not produced. Both jaws with a single series of small, pointed teeth. Scales rather large. Origin of the anal fin behind that of the dorsal. Sexes differentiated? Intestinal tract with numerous convolutions. Mud-eating.

Central America.

Although we know only the female of this fish, we conclude, from its close affinity to *Pœcilia* and *Mollienesia*, that the anal fin of the male is similarly modified.

1. Platypœcilus maculatus.

D. 10. A. 9. V. 6. L. lat. 25. L. transv. 8.

Body much compressed and elevated, its greatest depth being below the origin of the dorsal fin, and contained twice and one-third in the total (without caudal). Head less compressed than the body, the width of the interorbital space being nearly two-thirds of the length of the head, which is two-sevenths of the total (without

caudal). The diameter of the eye is more than the length of the snout, and one-third of the length of the head. The dorsal fin is rather large, longer than high, and its origin is a little nearer to the root of the caudal than to the extremity of the snout. Anal small, its origin being opposite to the middle of the dorsal. Caudal rounded; the free portion of the tail is short and high, its least depth being equal to the length of the head or to the distance between dorsal and caudal. The pectoral extends considerably beyond the root of the ventral, and the ventral reaches the origin of the anal.

Brownish olive, with a roundish black spot on the middle of the root of the caudal; a blackish spot on the middle of the side of the trunk. Dorsal sometimes densely spotted with black; the lower margin of the anal and the upper and lower margins of the caudal black.

Mexico.

a–b. One inch and a half long. From M. Sallé's Collection.

19. GIRARDINUS.

Girardinus, *Poey, Mem. Cub.* i. (1851) p. 383.

Cleft of the mouth small, mandible very short, with the bones not united, the dentary being moveable. Snout not produced, with the lower jaw more or less prominent. Both jaws with a single series of slender, moveable, pointed teeth, contracted at the base. Scales rather large. Origin of the anal fin generally in advance of, rarely opposite to, that of the dorsal. Anal fin of the male modified into an intromittent organ and much advanced. Intestinal tract with numerous convolutions. Mud-eating.

West Indies; Southern parts of North America.

1. Girardinus uninotatus.

Poey, Mem. Cub. ii. (1858) p. 309.

B. 5. D. 9. A. 11. L. lat. 35.

The height of the body is one-fifth of the total length (with the caudal), the length of the head two-elevenths or one-sixth. Eye longer than the snout, and contained twice and three-fourths in the length of the head. The dorsal fin of the female commences in the middle of the total length; ventrals reaching the vent. Anal process of the male very long, equal in length to its distance from the end of the snout, terminating in a clasper. Greenish brown, with a large round spot on the side, opposite the vent. (*Poey*.)

Cuba; river Tacotaco.

2. Girardinus metallicus.

Poey, l. c. p. 387, lam. 31. figs. 8–11.

B. 5. D. 9. A. 11. V. 6. L. lat. 30. Vert. 13/20.

The height of the body is somewhat more than the length of the

head, and rather less than one-fourth of the total (without caudal). In the female the origin of the dorsal fin is nearer to the extremity of the caudal, and opposite to the third or fourth anal ray; in the male it is nearer to the extremity of the snout. Anal process of the male nearly twice as long as the head, with recurved spines, and a clasper at its extremity. Pectoral and ventral fins short. Free portion of the tail moderately deep. Greenish, reticulated with brown, with silvery cross bands. A black spot at the posterior part of the base of the dorsal. (*Poey.*)

Cuba.

3. Girardinus versicolor.

D. 8. A. 8. V. 6. L. lat. 27. L. transv. 8.

The height of the body is somewhat more than the length of the head, which is contained thrice and three-fourths in the total (without caudal); the diameter of the eye is more than the length of the snout, two-fifths of that of the head, and three-fourths of the width of the interorbital space, which is nearly flat. In the female the origin of the dorsal fin is nearer to the extremity of the snout than to that of the caudal, and opposite to the second ray of the anal fin. Caudal fin of moderate size, as long as the head, rounded behind. The free portion of the tail is somewhat elongate, the length of the base of the anal being two-fifths of its distance from the caudal. Pectoral fin shorter than the head, and extending somewhat beyond the root of the ventral fins, which reach the vent. Reddish olive above, sometimes with indistinct silvery cross bars on the side of the tail; an indistinct dark band along the middle of the side, and, above it, two or three reticulated black spots, their number and situation being variable, even on both sides of the same individual; a black line along the lower and upper margins of the tail; a blackish blotch on the posterior rays of the dorsal fin.

San Domingo.

a–b. Females, from 1¼ to 1¾ inch long. Purchased of Mr. Cuming.

4. Girardinus reticulatus.

Pœcilia reticulata, *Peters, Monatsber. Ak. Wiss. Berl.* 1859, p. 412.

D. 7. A. 8. V. 6. L. lat. 27. L. transv. 9.

The height of the body is somewhat more than the length of the head, which is one-fourth of the total (without caudal); the diameter of the eye is more than the length of the snout, one-third of that of the head, and two-thirds of the width of the interorbital space, which is quite flat. In the female the origin of the dorsal fin is nearer to the extremity of the snout than to that of the caudal, and opposite to the second ray of the anal. Caudal fin large, longer than the head, rounded behind; the free portion of the tail is somewhat elongate, the length of the base of the anal being less than one-third of its distance from the caudal. Scales on the belly comparatively large, as large as those on the tail. Pectoral fin shorter than the head, and extending beyond the root of the ventral fins, which reach the vent.

Body uniform brownish olive, dorsal fin with the upper margin blackish.

Brazil; Caraccas.

a. Female, 2½ inches long. Brazil. From Mr. Clausen's Collection.
b–f. Females. Caraccas. Presented by the Berlin Museum.

5. Girardinus guppii.

D. 7–8. A. 8–9. V. 5. L. lat. 26–28. L. transv. 8.

The height of the body is two-sevenths of the total length (without caudal), the length of the head nearly one-fourth; males rather more slender. The diameter of the eye is more than the length of the snout, not quite one-third of that of the head, and three-fifths of the width of the interorbital space, which is flat. In both sexes the origin of the dorsal fin is somewhat nearer to the extremity of the snout than to that of the caudal, and in the female it is opposite to the origin of the anal. Caudal fin large, rather longer than the head, obtusely rounded behind. The free portion of the tail is somewhat elongate, the length of the base of the anal being one-third of its distance from the caudal. Pectoral fin as long as the head, not extending so far backwards as the ventral fins, which reach the origin of the anal.

In the *male* the anal fin is advanced to between the ventrals, which are elongate. The anal process, formed by two or three rays, is as long as the head, and without hooks.

The *female* is yellowish olive, with the belly silvery, and with the trunk above the belly blackish; all the scales with a narrow blackish edge.

The *male* is conspicuously marked: two brown streaks run along the trunk, and are sometimes confluent into a band; one brown streak runs along the middle of the side of the tail, a round black spot behind the shoulder, another at the commencement of the caudal streak, a third at the root of the caudal. One or two of these spots may be absent.

Trinidad; Venezuela.

a. Many male (1 inch long) and female (1½ inch long) specimens. Presented by Lechmere Guppy, Esq.
b–d. Adult male and females. Venezuela. Mr. Dyson's Collection.

The male from Venezuela differs somewhat in coloration from those from Trinidad. The spaces between the brown streaks are occupied by very large silvery patches, and there is a large ovate black spot in the middle of the side of the tail.

6. Girardinus pleurospilus.

D. 8. A. 9. V. 6. L. lat. 28. L. transv. 8.

The height of the body is somewhat more than the length of the the head, which is one-fourth of the total (without caudal); the diameter of the eye is more than the length of the snout, one-third of

that of the head, and two-thirds of the width of the interorbital space, which is slightly concave. In the female the origin of the dorsal fin is in the middle of the total length, and conspicuously behind that of the anal fin. Caudal fin large, longer than the head, subtruncate behind; the free portion of the tail is somewhat elongate, the length of the base of the anal being one-third of its distance from the caudal. Pectoral fin not quite as long as the head, and not extending so far backwards as the ventral fins, which reach the vent.

In the male the origin of the dorsal is somewhat nearer the extremity of the caudal than that of the snout; the anal process is quite straight, nearly twice as long as the head, and terminating in a simple tapering point. Caudal very short. Reddish olive, a series of six or seven round blackish spots, each about the size of the eye, runs along the middle of the side; a black line along the base of the anal fin, and the lower and upper margins of the tail. Caudal fin with two indistinct dark cross bands.

Guatemala.

a. Numerous females, from 1½ to 2 inches long, and one adult male, 1 inch long. Lake of Dueñas. From Mr. Salvin's Collection.

7. Girardinus formosus.

Girard, Proc. Acad. Nat. Sc. Philad. 1859, p. 62.

D. 7. A. 9. L. lat. 28.

Head a little less than one-fourth of the entire length; snout very short; the diameter of the eye two-fifths, or at most one-third, of the length of the head. Origin of the dorsal fin nearly equidistant between the extremities of the snout and of the caudal. Anal somewhat smaller than the dorsal, its origin being somewhat in advance of the dorsal. Pectorals extending beyond the root of the ventrals; ventrals reaching the vent. Brownish olive, with a black streak from the snout, along the middle of the side, crossed by six or eight brownish-black vertical streaks; a black spot at the base of the caudal, dorsal, and anal.

Florida and South Carolina.

Female, 1 inch long. Male ⅝ inch.

8. Girardinus occidentalis.

Heterandria occidentalis, *Baird & Girard, Proc. Acad. Nat. Sc. Philad.* 1853, p. 390.

Girardinus occidentalis, *Girard, U. S. & Mex. Bound. Ichth.* p. 73, pl. 39. figs. 16–19; and *Proc. Acad. Nat. Sc. Philad.* 1859, p. 119.

D. 7. A. 7. V. 6.

The height of the body is about equal to the length of the head, which is somewhat more than one-fourth of the total (without caudal); in the female the origin of the dorsal fin is somewhat nearer to the extremity of the snout than to that of the caudal, and nearly opposite to the origin of the anal. Free portion of the tail elongate. Reddish brown above, with a more or less distinct black stripe along

the middle of the side; a black line along the lower margin of the tail. Fins of uniform colour. (*Girard.*)

Rio Santa Cruz (Mexico).

9. Girardinus sonoriensis.

Girard, Proc. Acad. Nat. Sc. Philad. 1859, p. 120.

D. 8. A. 8. V. 6.

Very similar to *G. occidentalis*. Length of the head about one-fifth of the total (with the caudal). Dark chestnut-brown, with a more or less conspicuous black lateral band; a dark line along the lower margin of the tail. (*Girard.*)

San Bernardino Creek (Mexico). Probably identical with *G. occidentalis*.

10. Girardinus decemmaculatus.

Pœcilia decemmaculata, *Jenyns, Voy. Beagle, Fish.* p. 115, pl. 22. fig. 1.

? Pœcilia gracilis, *Cuv. & Val.* xviii. p. 133.

D. 8. A. 10. V. 6. L. lat. 30. L. transv. 9.

The height of the body is somewhat more than the length of the head, which is not quite one-fourth of the total (without caudal); the diameter of the eye is much more than the length of the snout, one-third of the length of the head, and equal to the width of the interorbital space. In the female (which sex only is known), the origin of the dorsal fin is nearer to the extremity of the snout than to that of the caudal, and but little behind that of the anal. Caudal fin large, as long as the head, slightly rounded behind. The free portion of the tail elongate. A series of about ten irregular blackish spots, smaller than the eye, runs along the middle of the side; a black line along the lower and upper margins of the tail.

Maldonado (Uruguay).

a. One of the typical specimens, 1 inch long. Voyage of the 'Beagle.'

Appendix to the Cyprinodontidæ.

LEBISTES.

Lebistes, *De Filippi, Arch. per la Zool. l'Anat. &c.* 1862, i. p. 69.

Cleft of the mouth small, with the lower jaw projecting beyond the upper, both jaws with a narrow band of very small teeth, those in the outer series being the largest. Scales of moderate size. Dorsal and anal fins short; anal in advance of the dorsal, with the second and third rays much thickened and elongate *in both sexes*. The second ventral ray is the longest, and [in the females, terminating in a hook?]*.

Island of Barbadoes.

If the characters assigned to this very doubtful genus are correct,

* According to the figure, in the male!

it differs in a very extraordinary manner from the other fish of this family in which sexual differences are observed. From an inspection of the figure, we should have considered the specimen to be a male; but Prof. De Filippi says distinctly that the peculiar anal fin is found in the female as well as in the male.

1. Lebistes poeciloides.

De Filippi, l. c. taf. 4. fig. 6.

D. 9. A. 7. V. 6. L. lat. 34. L. transv. 8.

The specimens are 1½ inch long.

Barbadoes.

ADDENDA.

Page 14. **Salmo salar.**

a'. Fine male specimen, 3 feet long. Beauly. Presented by Lord Lovat as "Bull-trout". Caught in the beginning of April; testicles entirely collapsed.

Whilst this sheet was passing through the press, Lord Lovat's kindness afforded me an opportunity of seeing other specimens of "Bull-trout" at the moment when taken from the water. It is his opinion that at least some of the fish are hybrids between the Salmon and Sea-trout (*S. trutta*), an opinion confirmed by external appearance and by the varying number of pyloric appendages, which, in one specimen, was found to be as low as fifty-four; yet the relative size of the scales on the tail is in all these Bull-trout the same as in the Salmon. Capt. H. Fraser believes that other specimens of "Bull-trout" are true Salmon which, having gone down to the sea as Kelts, return to fresh water before having attained to the condition of well-mended fish. Thus, as regards the river Beauly at least, fishes named "Bull-trout" do not constitute a distinct species, but this name would appear to comprise—

1. Hybrids between Salmon and Sea-trout.
2. Specimens of Salmon returning from the sea before being well mended.
3. Sterile specimens—as, for instance, the specimen (*a'*) mentioned above.

The differences between "Bull-trout" and Salmon are sometimes so slight as to be scarcely perceptible by an inexperienced eye. From what I have seen on the Beauly in the month of August, I should say that the numbers of Salmon, Bull-trout, and Sea-trout are as 30 : 3 : 1.

I may also add here that I have seen specimens of *Salmo brachypoma* in the same river, and that they are named there "Phinok," a name used for the Grilse-state of *S. trutta* on other rivers. Specimens of *S. fario* frequently descend to the sea, and assume a bright silvery coloration, with numerous X-shaped spots.

Page 172. **Retropinna richardsonii.**

k–m. Adult. From the Haslar Collection.

Page 200. **Thymallus vulgaris.**

This species is also found south of the Alps.

y. Fine specimen. Col de Tende (Maritime Alps). From Dr. Deakin's Collection.

Page 203. **Argentina sphyræna.**

c. Seven inches and a half long. Nice. From Dr. Deakin's Collection.

Page 219. **Mormyrus brachyistius.**

a. Fine specimen. Sierra Leone. Purchased of Mr. Stevens.

The height of the body is somewhat more than the length of the head, which is one-fifth of the total (without caudal). Pectoral reaching slightly beyond the base of the ventral. A. 29.

Page 232. **Umbra limi.**

h. Adult. United States. Purchased.

Page 240. **Belone choram.**

d. Adult. Presented by Dr. Alexander Smith.—This specimen is said to be from the coast of the Camaroon district (West Africa).

Page 269. **Hemirhamphus pleii.**

k. Adult. Trinidad. Purchased of Mr. Cutter.

Page 281. **Exocœtus brachypterus.**

c. Five inches and a half long. Formosa. From Consul Swinhoe's Collection.

Page 313. **Haplochilus infrafasciatus.**

Specimen *b* ought to be referred to *H. fasciolatus*.

Page 314. Add a new species:—

9 *a*. Haplochilus fasciolatus.

D. 11. A. 18. V. 6–7. L. lat. 28. L. transv. 9–10.

The height of the body is a little less than the length of the head, and one-fourth of the total (without caudal). Head rather elongate, much depressed anteriorly, the snout being longer than the eye, the diameter of which is somewhat more than one-fourth of the length of the head, and one-half of the width of the interorbital space. Lower jaw a little longer than upper. Origin of the dorsal fin midway between the extremity of the caudal and the eye, corresponding to the seventeenth scale of the lateral line, and being rather before the middle of the anal. Pectoral fin extending somewhat beyond the root of the ventral, which reaches the vent. Brownish, each scale with a red spot at the base, disappearing in preserved specimens; the lower parts of the sides of the abdomen and tail with eight or nine oblique narrow brownish-black streaks, descending from the middle of the side forwards. Vertical fins with purple spots, dorsal and anal with a light basal band.

Sierra Leone; Upper Nile.

a–e. From 1½ to 3 inches long. Sierra Leone. Presented by Dr. A. Günther.

f. One inch long. Upper Nile. From Consul Petherick's Collection.

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